Steam Locomotives

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COVER: When he was new back in 1941, Union Pacific's Big Boy — the world's largest reciprocating steam locomotive — paused for his portrait in Weber Canyon, Utah. UP operates 25 of the Alco-built monsters over its heavily-trafficked main stem west out of Cheyenne to Laramie, Wyo.

BELOW: Milwaukee Road Extra 231 East battles out of Milwaukee past the Washington Street tower; soon its huge 4-8-4 — fresh from the back shops at West Milwaukee — will be wheeling its tonnage over the road's famous speedway to Chicago. Kodachrome photo by A. C. Kalmbach.

Steam Locomotives

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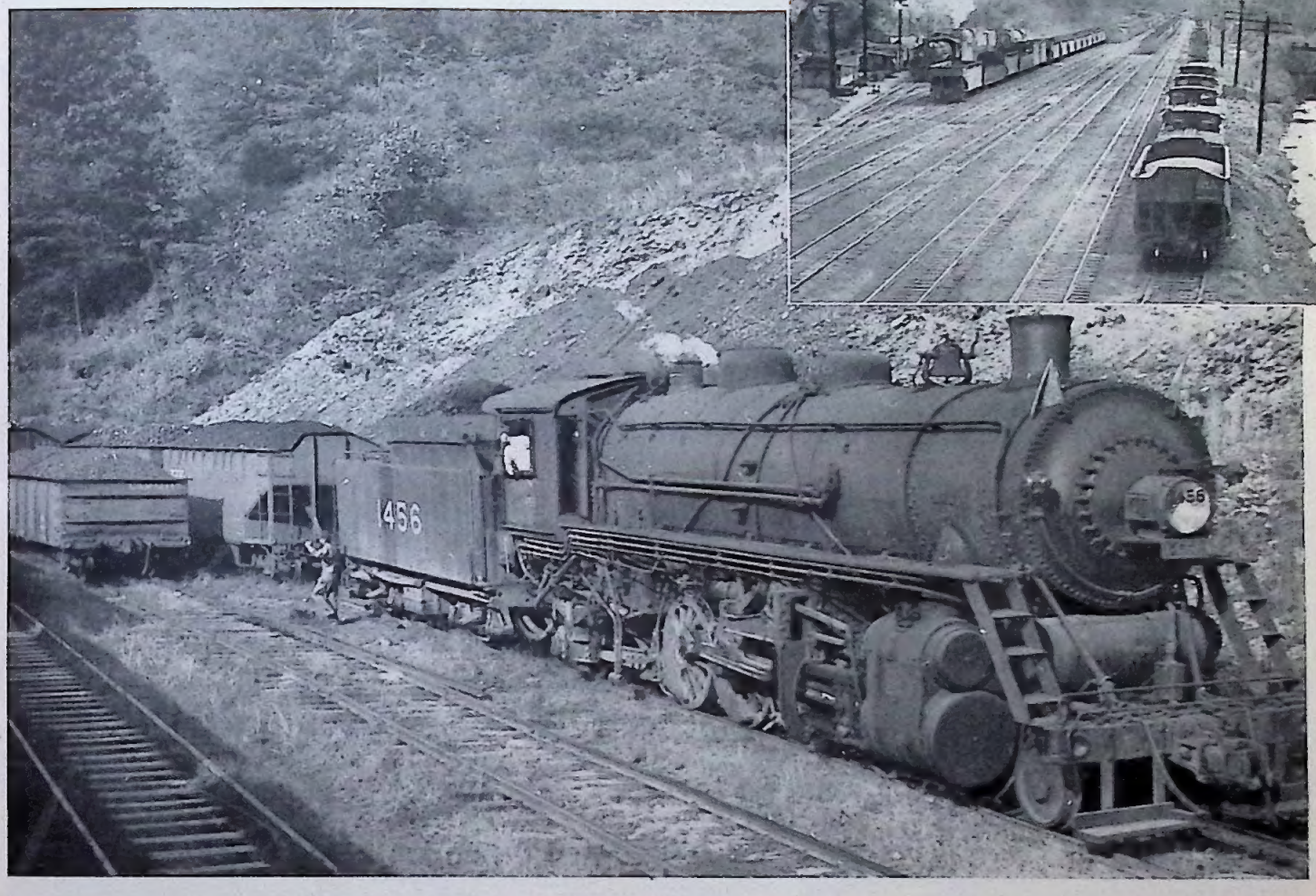
Mikado No. 1425, with white flags flapping on her smokebox, moves 19 cars of cinder ballast up the new 17-mile Rockhouse Creek Branch Extension, one of the postwar construction projects (1948) that has swelled E.K. Division coal traffic. No. 1425 was built by the L&N during World War I.

Steam success story



↑Cars picked up by L&N-built No. 1456 on this mine run to Elkhorn No. 6 will be moved to Neon yards (top) and assembled into 9500-ton drags for movement to DeCoursey.

↗A caboose the size of a box car brings up the tail end of a coal drag in Hazard. Cons and hoppers are loaded by grade of coal, hence slack-to-lump variety.

To save $1 million a year, spend $7.6 million on five diesel road units, 22 Berkshires, and additional C.T.C. mileage. Estimated annual return on investment: 13.1 per cent.

This high school blackboard examination of modernizing coal hauling on the Louisville & Nashville's Eastern Kentucky Division would indicate that the task was elementary. It was not. But the italics are a clue to a notable post-war example of modern railroading which features an almost unique blending of new steam and diesel locomotives.

Understanding how the L&N effected a $1 million annual saving must first be keyed to the E.K. Division's role in the movement of coal, a commodity which might be termed an insurance policy for the carrier since it accounts for 52 per cent of its tonnage (39 million tons in 1948) and 32 per cent

BIG POWER COMES

BEFORE its big 2-8-4's could turn a driver on the Eastern Kentucky Division south of Ravenna, Louisville & Nashville was obliged to invest several hundred thousand dollars in the line to handle the increased dimensions of the heavier power. Concrete abutments replaced wood piling beneath bridges, Chenowee Tunnel was bored larger with pneumatic drills, and the Hazard turntable received a three-point contact for better weight dis-

←Hazard's 100-foot turntable receives attention of traveling crane during its reconstruction for M-1's. ←Silhouette of M-1 (plus sway allowance) is tested for clearance in Chenowee Tunnel. ↓Extra gang spikes home rail near Irvine.

tribution as well as new traction motors. The Ravenna table had to be widened for the M-1's length and rebuilt for its weight. New 132-pound rail was spiked down in place of 100-pound sections from Patio south. The Berkshires did not roll over the E.K. Division on regular schedules until Lima-Hamilton delivered an additional 22 of the machines but Baldwin M-1's made clearance tests.

J-1 Mikado

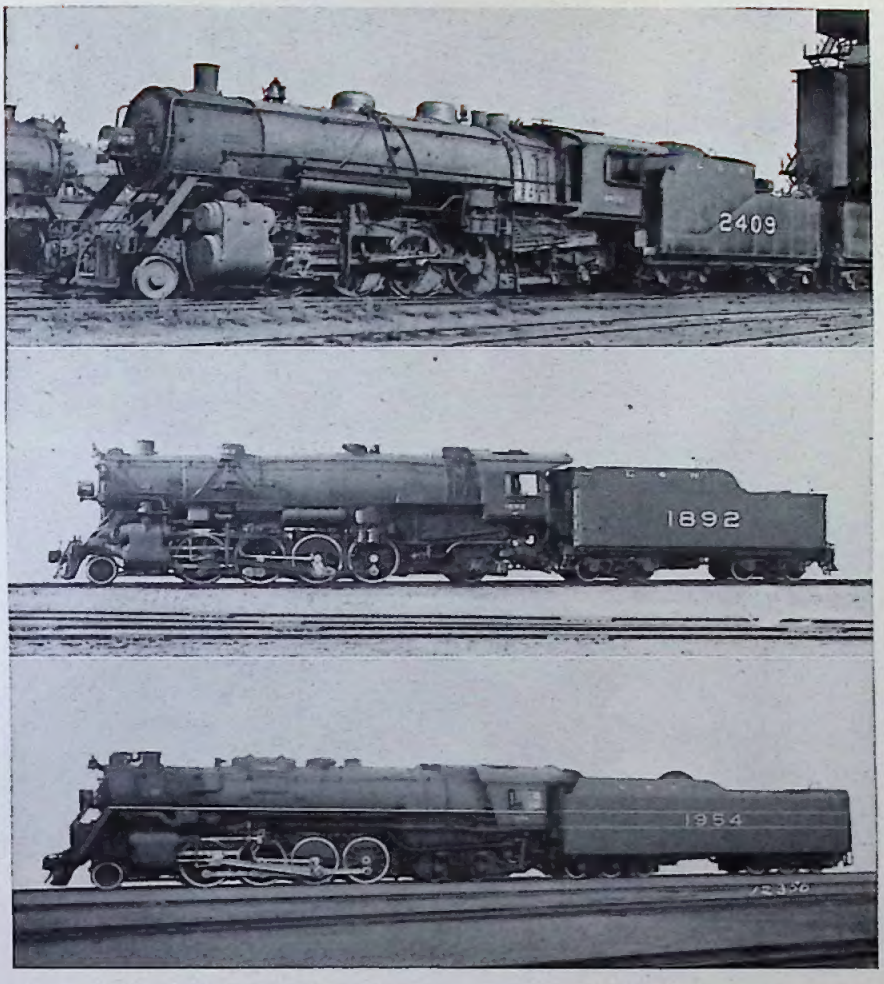
↗No. 2409 typifies the L&N-built (South Louisville Shops) power that handled system drags before advent of U.S.R.A. power. Today these 2400's and 1400's work mine runs on the E.K. Division and transfer drags out of DeCoursey. Robert J. Foster.

J-4a Mikado

↗This modification of the U.S.R.A. heavy Mike, with its Delta trailer and feedwater heater differences, was the L&N's most powerful locomotive before the M-1. Baldwin built 23 of them in 1929, company shops added boosters.

M-1 Berkshire

→L&N's M-1 2-8-4 is one of the most thoroughly modern steam locomotives in American railroading, equipped with high-speed booster and roller bearings on all axles. Baldwin built 14 in 1942, six in 1944; Lima delivered next 22.



M-1's also work the Cincinnati Division as far south as Corbin, run over the Cumberland Valley line, and go to Louisville for classified repairs.

Operating efficiency of these 42 Berkshires (series 1950-1991) has been as splendid as their road performance. They average over 5100 miles a month each in drag service on a comparatively short haul district, can be turned in 1½ hours, and burn 12 per cent less coal than the Mikes they replaced.

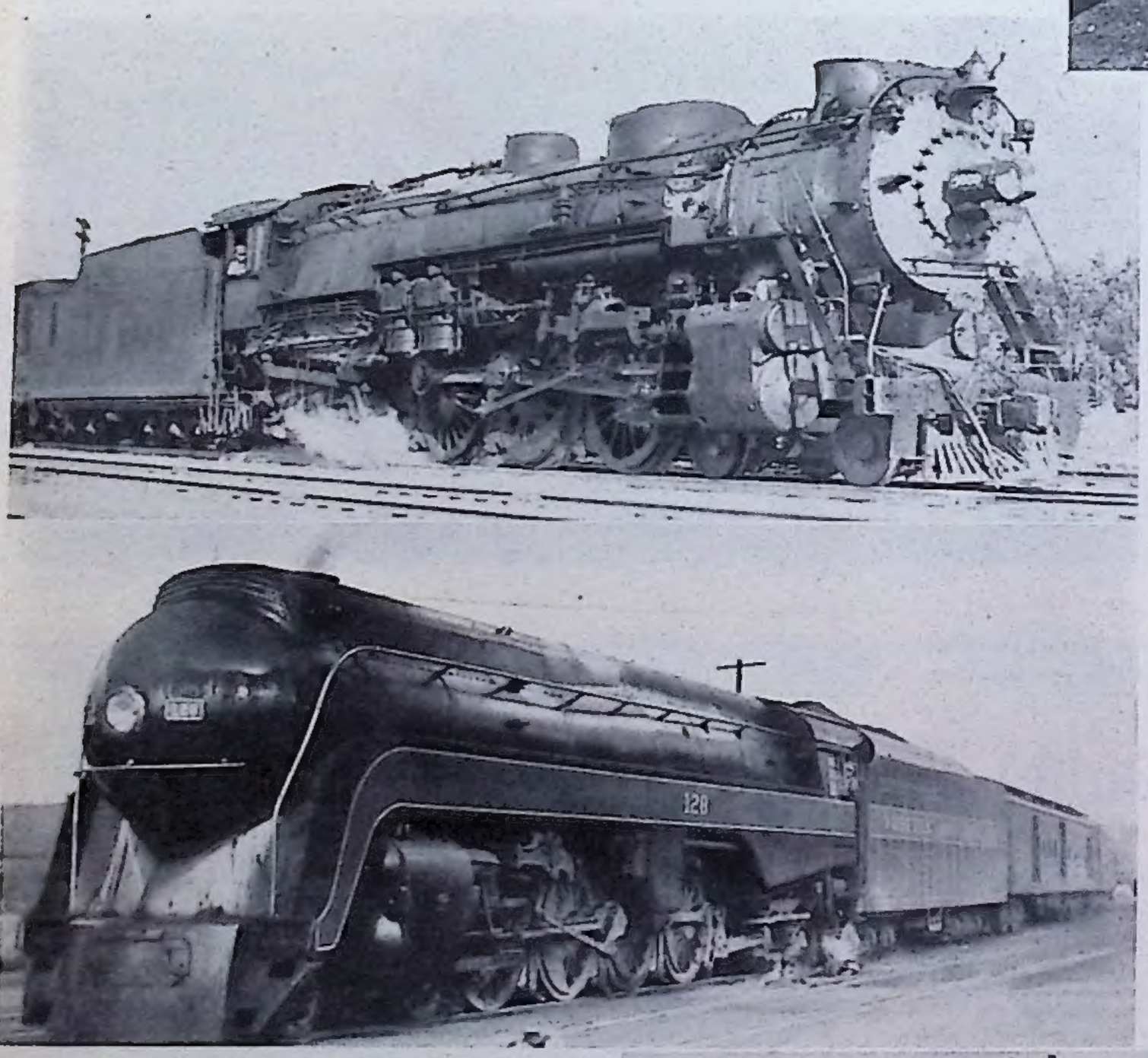
The diesel hasn't been doing so bad, either. Systemwide tests made with it during coal strikes have resulted in an L&N order for 37 similar units. These diesels are not destined for the E.K. Division, however; there the M-1 still stands supreme.

←Lima-built No. 1990 leads a 9500-ton coal train into DeCoursey Yard where a radio-equipped hump engine will shove the cars over the hump for Cincinnati interchange classification. An M-1 may be turned for a return trip in 1½ hours, then ↗ dispatched back to the mines with empties. Baldwin sister No. 1956's flags catch the wind as white exhaust goes up over DeCoursey.

Streamlined makeshifts

A before-and-after photo portfolio revealing the secrets of a peculiar breed of steam locomotive born after 1933

↗Big Alice the Goon (or more politely, the Aeolus) was delivered to the Burlington by Baldwin in 1930 as S-4 Hudson No. 3002. Advent of Zephyrs caused her



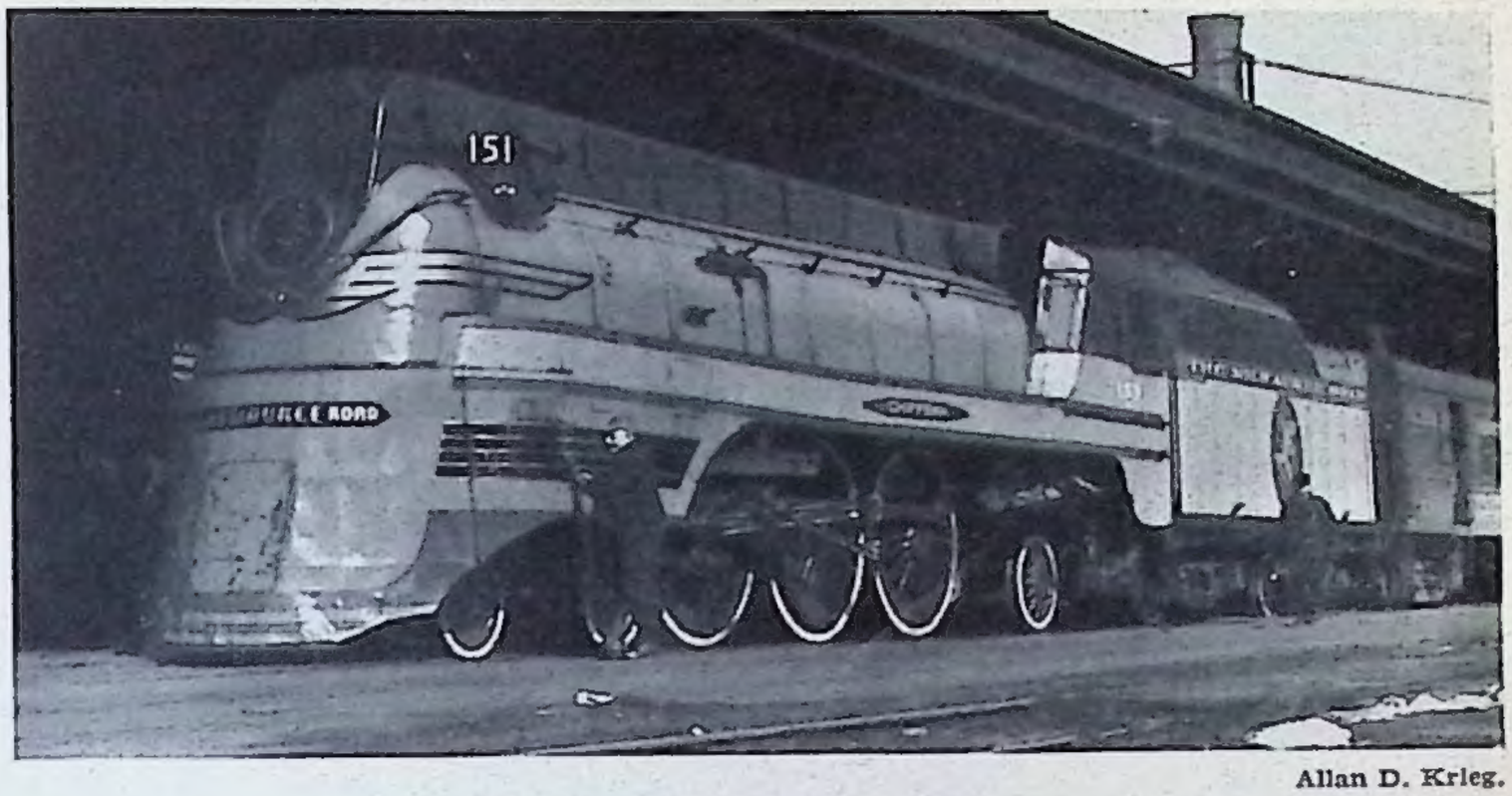
Top, Bernard Corbin; bottom, W. R. Hicks.

Until the advent of its famous Roanoke-built J-class 4-8-4 in 1941, the Norfolk & Western Railway's heaviest passenger power was the M-2 Mountain (later M-2a when boiler pressure was raised from 200 to 220 pounds). →No. 122, forwarding the westbound Pocahontas through South Norfolk and over a Virginian Railway grade crossing, was typical of the modified (by feedwater heater, big tank and horizontal barred pilot) heavy U.S.R.A. 4-8-2 design before rebuilding. ↑Sister 128, after reconstruction at Roanoke, replaces a Pennsylvania K-4 at the business end of a southbound train out of Hagerstown, Md., where N&W's Shenandoah Valley Line joins rails of controlling road. Distinctive note is streamlined feedwater heater.

Richard E. Prince Jr.

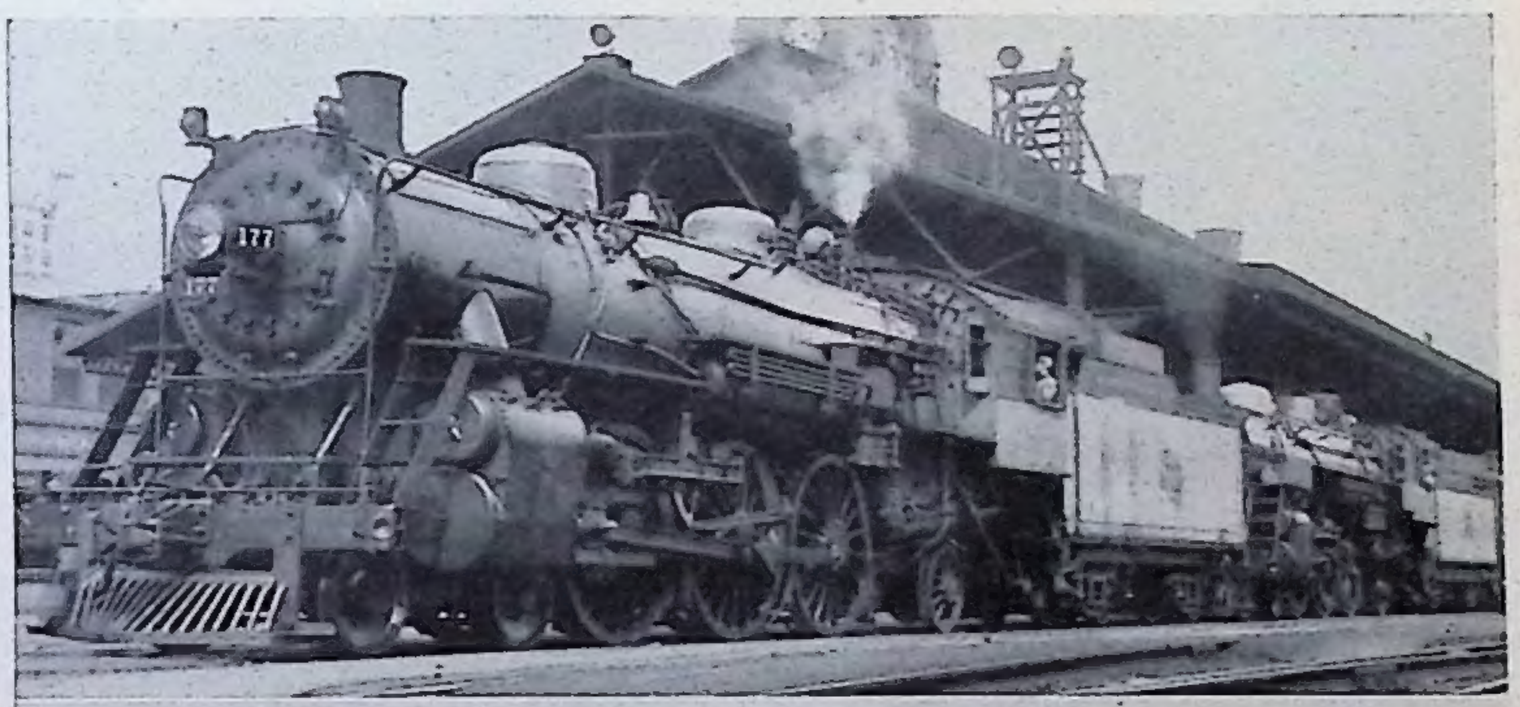
THE time-worn cartoon that depicted an overhead shop crane lifting a shroud off an old slide-valve 4-4-0 to the astonishment of all bystanders but the master mechanic may be traced to a breed of locomotive peculiar to the age of streamlining — that is, post 1933. These engines can be defined as conventional passenger locomotives rebuilt to simulate genuine streamlined units, with or without mechanical improvements, because the railroad didn't have enough cash to buy the real McCoy custom. Certain streamliners of prewar vintage were originally powered by such makeshift power. The list is fairly diverse, embracing Michigan Central's hooded *Mercury* Pacifics, the similarly styled Union Pacific *Forty Niner* (now no more) 4-6-2 and 4-8-2, and the vari-

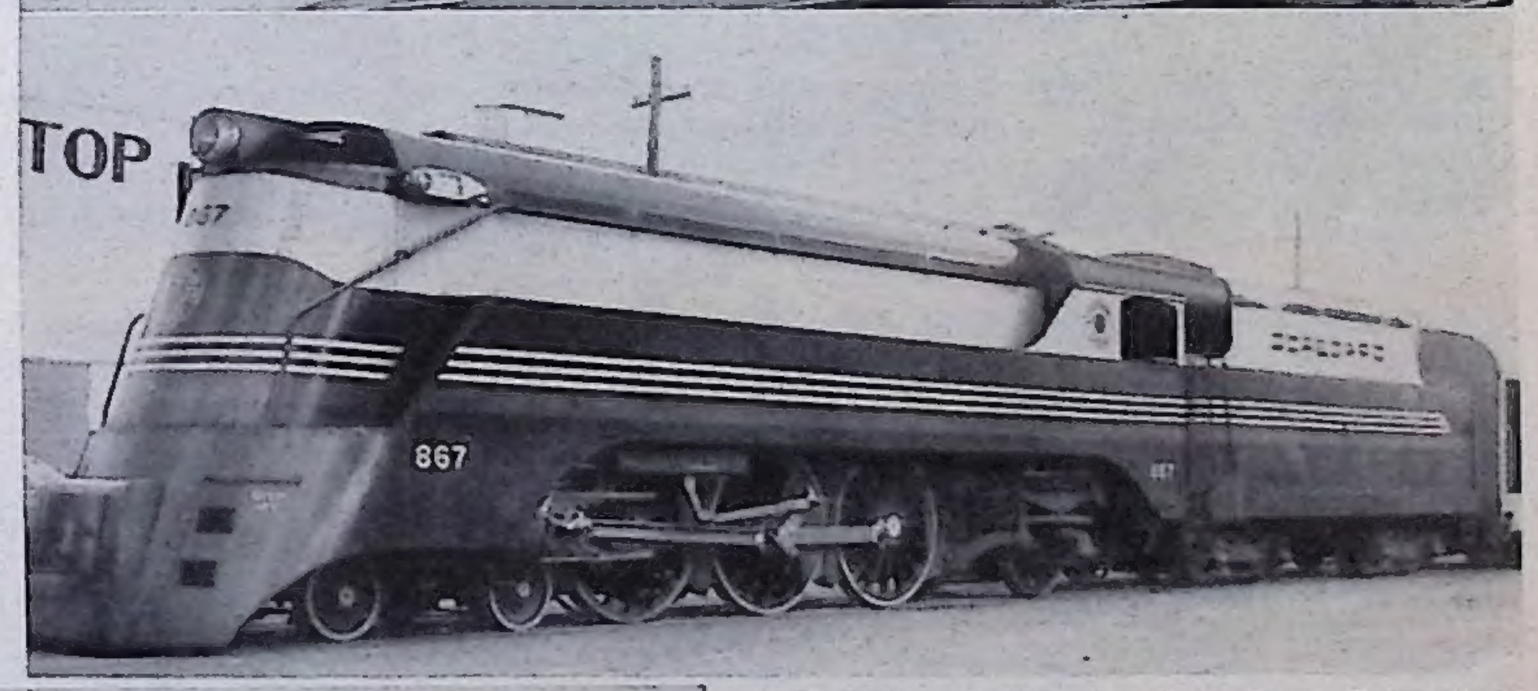
reconstruction by West Burlington Shops in 1937 with new number (4000), stainless-steel jacket, lightweight rodding, roller bearings. ←Shroud was removed in 1941.



Allan D. Krieg.

↗Streamlined to simulate the Otto Kuhler treatment of the Milwaukee Road's Alco-built F-7 Hudsons, Pacific No. 151 is one of a set that still handles the Chippewa Hiawatha from Milwaukee to Ontonagon, Mich. ↓Before streamlining, "Chip" was powered by Pacifics painted Hiawatha hues.



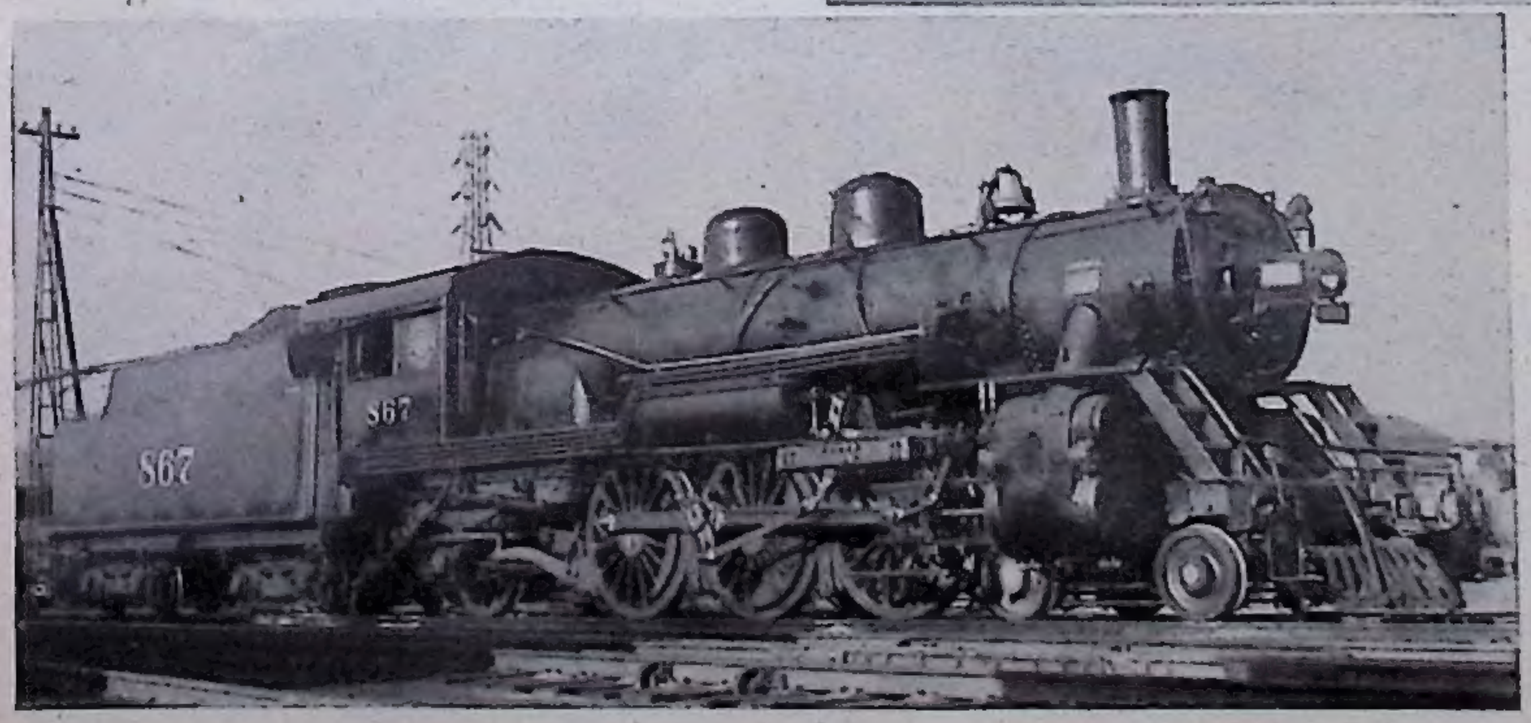


Top, Henry J. McCord; bottom, George Pettengill Jr.

ous rebuilds that hauled the *Dixie Flagler* and *South Wind*—just to name a few selections.

The locomotives illustrated in the pages of this photo spread are members of this same unique clan but residents of another house. The streamliners they haul are commonly powered by custom-styled 4-6-4's and 4-8-4's or standard diesel units. The proxies pinch hit when this assigned power requires repairs or fails on the road, and they haul connecting trains that operate as feeders to mainline streamliners.

Two basic histories explain the two basic needs which these streamlined makeshifts were created to satisfy. Southern Pacific made a fast daylight service to Los Angeles available to Sacramento when it scheduled a *San*

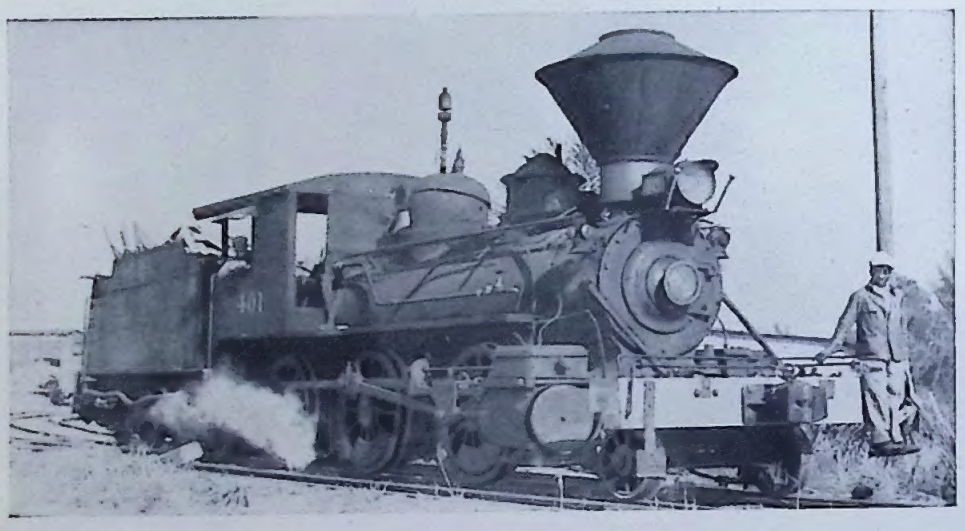


Richard E. Prince Jr.

Seaboard Air Line's tall-stacked P-class Pacifics were once its finest passenger power, even sported bronze eagle emblems on Atlanta-Birmingham schedules as late as 1938. A last chance for fame came in 1940 when Nos. 865 and 868 were shrouded to pull the west coast section of the Silver Meteor from Wildwood to St. Petersburg, Fla. In 1941 sister No. 867← was given the same beauty salon treatment in Jacksonville to emerge↑ in the diesel design of the other two. Jacket was yellow, orange and olive drab—with yellow driver tires and wheel trim. M-2 Mountains finally had to take over headend of heavier wartime Meteors and the Pacifics lost their shrouds to the scrap drive.

FLORIDA WOODBUR

PHOTOS AND DATA BY GEORGE W. PETTENGILL JR.



Ten years ago No. 401 (above and at left below) was owned by the Manatee Crate Company, near Bradenton, Fla. Her history is hard to trace, but she previously had hauled log trains over a line between Manatee and Arcadia. No. 1252, at right below, is a Ten-Wheeler that saw common-carrier service on the old Plant System and later on the Atlantic Coast Line. 1252 is her old ACL number.

NERS

Lumber railroads still use scrap-burning locomotives

↑Dowling & Camp Lumber Company's No. 103 breezes along near Fort Myers on the Seaboard's La Belle branch, over which D&C has trackage rights. ↓Brooks-Scanlon Corporation's well-kept Porter-built Mogul No. 7, complete with water hose on tender, rests in pine woods south of Perry.

THE ERA of the woodburning locomotive in Florida is coming to a close. In the Roaring '20's woodburners were common on a few branches of both the Atlantic Coast Line and the Seaboard Air Line. Such roads as the Live Oak, Perry & Gulf, Trans-Florida Central, Tavares & Gulf, Ocala Northern and the East & West Coast Railroad used woodburners in regular passenger service.

Sawmills using locomotives for yardwork and interchange with main-line railroads constitute just about the last stronghold of the Florida woodburner. The last of the woodburning common carriers, the Live Oak, Perry & Gulf, has turned to coal and diesels. Yet, if you know where to look, you may still see some of the balloon-stackers in action.

Continued on next page

E. G. Baker.

Old and forgotten

SHE was really only one of many. A Pacific of cultured design with a high boiler and a large cab. Slide valves, Stephenson gear, inboard trailers. Company shops built her in 1907. Then came the limiteds, next the secondary varnish, finally the plug runs. And then . . . well, Strawberry accepted her then.

Strawberry. An odd name for a graveyard of old and obsolete and forgotten locomotives, perhaps. But before the market crash it had been a busy terminal — active with the smoke of many switchers and the roll of many cars. When traffic fell, they pulled the switchers out and locked up the yard office and pulled the searchlights off the high girder towers.

And then Strawberry's many sidings gathered the brown-red rust of many seasons. The paths worn distinct by the car checkers filled up with reeds; the tracks were filled up with bad-order box cars and the old and obsolete and forgotten locomotives.

Have you ever observed a proud locomotive that has been cast out into the weeds and the weather to rust? It is an experience one never forgets.

To enter Strawberry, you crossed the double-track Nashville main line, climbed over the wire fence, and walked through the eternal weeds to the long ranks of the old and the obsolete and the forgotten.

She stood out there in the company of other locomotives: Consolidations, 4-6-0's, one American Standard, two experimentals, a set of switchers. All had once been bright in shiny black; all had once known the white heat of a good fire, the sway of speed building up, and the custom of a regular stall in the house. Strawberry ended all that. Strawberry offered only the sad peace of loneliness — and the corrosion of the wind, the rain, the snows.

The wind out of a gray, bleak fall sky would flap the remnants of a cab curtain and rustle the weeds around driver flanges. The Pacific's bell was missing, her headlight was gone, her inner smokebox door stood ajar.

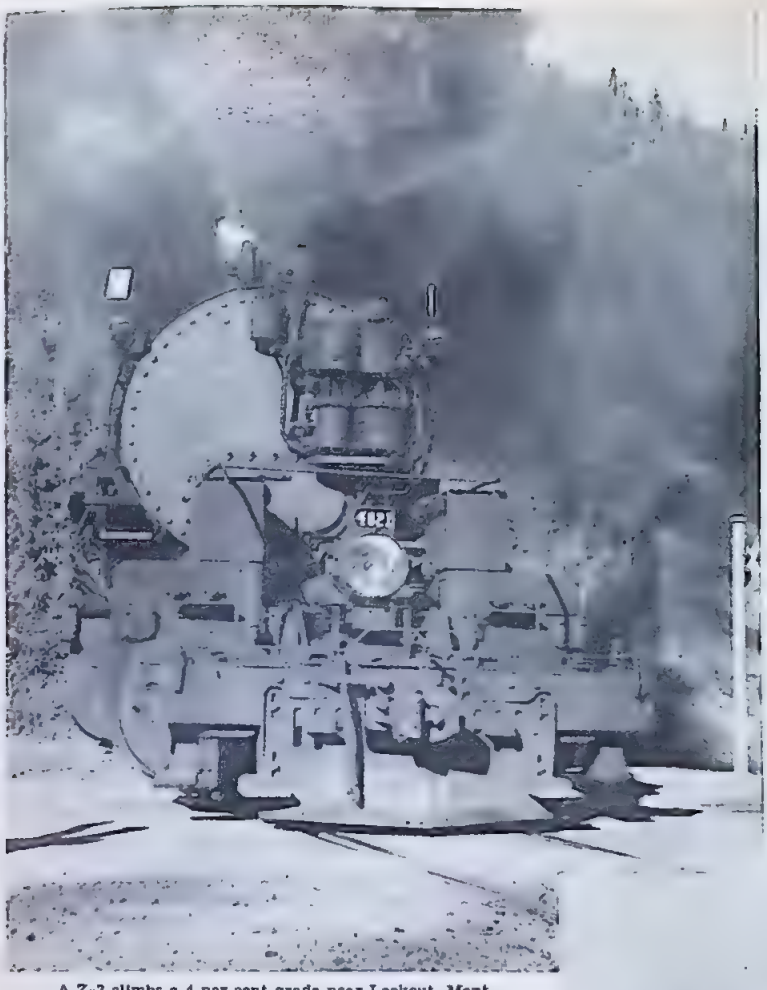
The men with blowtorches and electric magnet cranes came in 1939. From foundry to scrap in 32 years. Without ceremony or style they went to work on the Pacific, cutting her up, swinging the lacerated and broken tubes and running gear into a nearby gondola.

Strawberry is a busy terminal again — active now with the growl of many diesels and the roll of many cars. The old and obsolete and forgotten locomotives have been *forgotten*. — D.P.M.

Northern Pacific locomotives

"The Main Street of the Northwest" is famous as a pioneer in the development of the 4-8-4 and the 2-8-8-4

PHOTOS AND DATA BY R. V. NIXON



A Z-3 climbs a 4 per cent grade near Lookout, Mont.

NORTHERN PACIFIC, first of the northwest transcontinentals, has earned a secure and romantic page in the great legend of railroading. It was born of a charter signed by one A. Lincoln in 1864, then was subsequently riddled and almost killed by receiverships and panics, fiery Indian warfare and enormous operating handicaps. But though it came of turbulent times and now makes a living between the main lines of two aggressive rivals (Great Northern and Milwaukee Road), Northern Pacific has arrived in 1949 by its own sweat and hard work. Its 6682 miles of first track, built from Duluth and St. Paul across Dakota Territory and over the Rockies and Cascades to Seattle and Tacoma, stands today as an enduring, serviceable "Main Street of the Northwest."

Much of the credit for NP's solvent existence belongs to its locomotives. In motive power NP has always been a leader. For mountain grades and long-distance prairie running it originated the 4-8-4, now owns many of the best Northerns in the nation; its NP-developed Yellowstone (2-8-8-4) was the world's largest for more than a decade; it was a buyer of EMD's record-breaking FT 5400-horsepower freight diesels. These selected photographs are by an ex-NP dispatcher.

The Atlantic was never as popular on the NP as it was on the GN and CMStP&P; the road owned just six in its history. Three were inherited from the St. Paul & Duluth, labeled as class S. The other three S-1 machines, like No. 603, were built by Baldwin in 1909. All are now scrapped.

This top-heavy Ten-Wheeler, built by Alco's Rogers Works in 1907, is the last of 10 rough-riding S-10 locomotives which were reportedly designed and built for Russia but never shipped. No. 328 worked the majestically scenic Taylors Falls branch until it was ripped out in 1948.

Electro-Motive F-3

No. 6504, a 4500-horsepower Electro-Motive F-3 geared and painted for North Coast Limited service, stands in St. Paul in January, 1947, ready for her maiden trip west. This locomotive now has an "A" or cab unit at each end. All three Northwest roads use different diesels to power their streamliners: GN employs 4000-horsepower EMD E-7's; Milwaukee Road, F-M's.

SWITCHERS

L-4 Shop Saddletanker

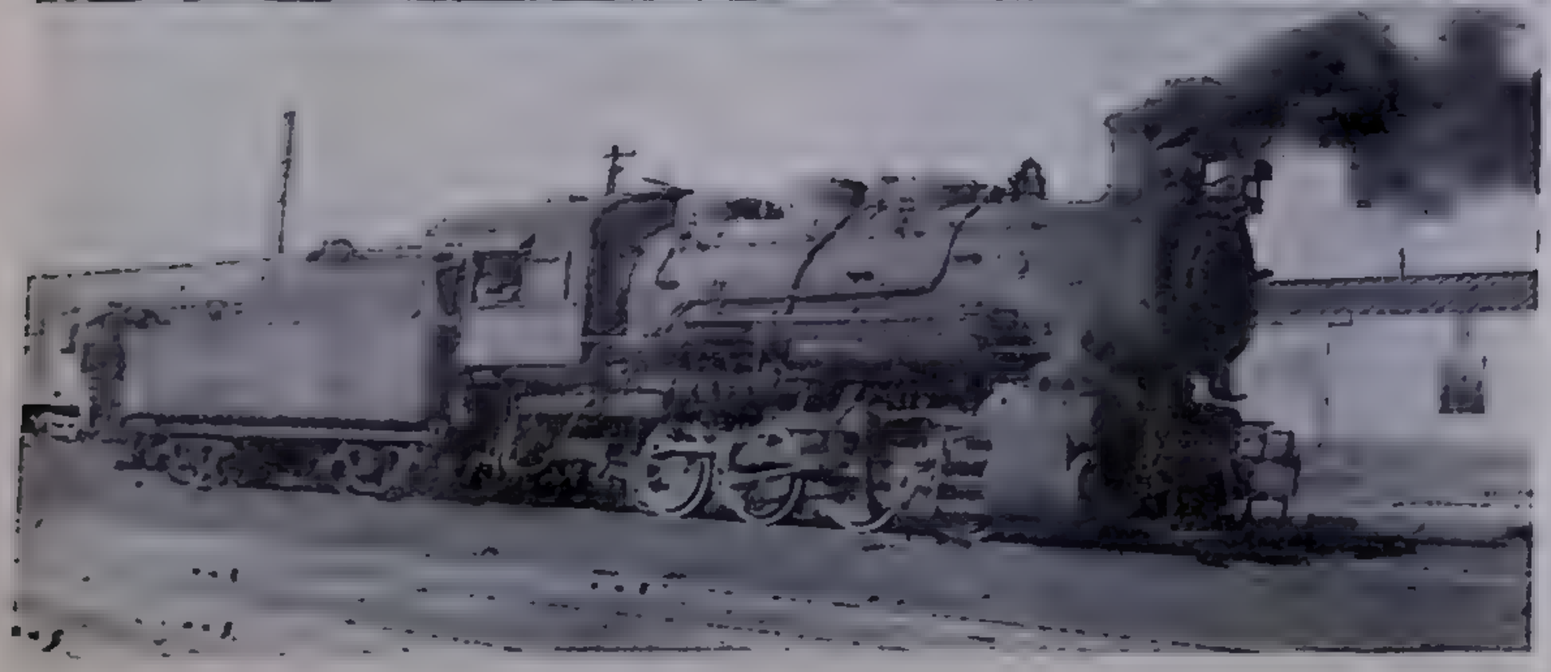
No. 10 has the distinction of being the oldest locomotive on the Northern Pacific. It was built as a standard six-wheel shifter by Baldwin in 1896 for the old St. Paul & Duluth, was later renumbered 927, and finally was rebuilt into a saddletank and given its present number. It is employed at the Brainerd (Minn.) shops. The small bunker carries coal for short shop moves.

L-10 Six-coupled

No. 1168, one of 10 L-10 switchers built for the NP by Schenectady in 1912, is typical of a hundred thousand little 0-6-0's delivered to the bustling yards of American roads in the early 1900's; yet this sturdy engine is rendered "NP" on first sight by her unique headlight jacket. The engines of class L-10, which have piston valves and Stephenson gear, are all in service.

G-1 Eight-coupled

U.S.R.A. locomotives very seldom found their way into the Far West; the bulk of them were delivered to carriers in the East, South and Midwest. However, four of these G-1 class U.S.R.A. 0-8-0's, built by Brooks in 1919, were dispatched to the Northern Pacific and all are still very much in service. No. 1172, shown in St. Paul, is equipped with a tender coal pusher.



G-2 Eight-coupled

Success in locomotives is reflected in the duplication of the same design. Because it liked the performance of its U.S.R.A. 0-8-0's so much, NP purchased 20 similar G-2's from Alco in 1920. All are in service, scattered over NP's 6682-mile system. No. 1181 has a boiler blow-off valve mounted between domes, a headlight generator ahead of stack, and a coal pusher.

Alco-GE Diesel

Northern Pacific, in common with virtually all other carriers in the United States, tried and liked the diesel switcher, now has 51 of them in many designs. No. 125, a 660-horsepower Alco-GE model, is one of the road's earliest ventures into the diesel field. It is all dressed up in its new livery in this picture at Missoula, Mont., in 1940. Note old-style high hood.

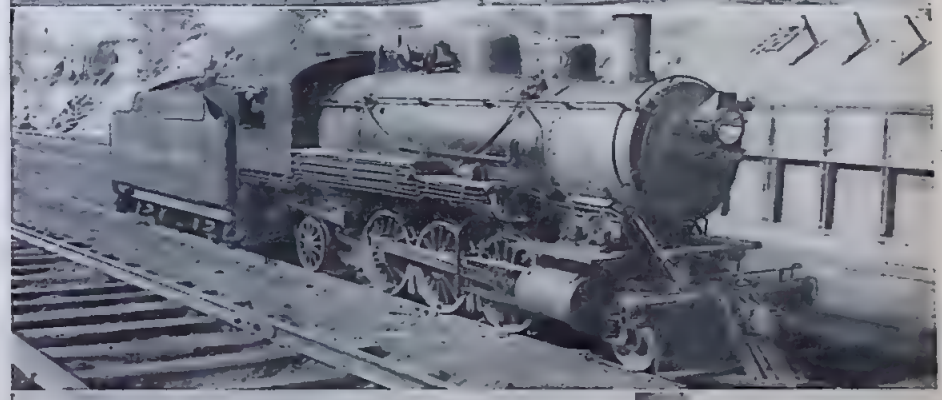
Alco-GE Road-Switcher

One of the most versatile units in the diesel line is the road-switcher. In road service it can be used in commuter schedules, for branch-line mixed trains, or on way freights. When or where road usage is impractical the unit doubles nicely as a yard goat. No. 158, an Alco-GE 1500-horsepower model, is typical of this trend in motive power. NP owns seven road-switchers.

FREIGHT POWER

Class T Prairie

The 2-6-2 Prairie, originally introduced on the Burlington (in which NP owns a half interest), was highly popular with many western roads. NP itself invested in 150 class T locomotives like No. 2360, all delivered by Brooks in 1906-07. Later, 18 were modified into T-1's. Now only 18 T's and 14 T-1's remain in active service; the Prairie is fast slipping from railroading.



Class M Decapod

Northern Pacific invested in only two 2-10-0's, but when these class M locomotives were delivered as Nos. 500-501 by Baldwin in 1886 they were reportedly the world's largest, a distinction that belonged to NP again within 50 years. Nos. 1 and 2, as they were later designated, were built for rugged Cascade Mountain grades. The low-drivered Decapods are now scrapped.

Class Y Consolidation

Northern Pacific, once an enthusiastic compound road, purchased 14 Schenectady cross-compounds in 1898. Later all were rebuilt to simple locomotives like No. 36. Class Y engines were used in road freight service until the early 1920's, then were assigned to heavy switching duties. The class Y's traits are a low-hung boiler, piston valves and Stephenson valve gear.

Famous steam locomotives:

Loree's locomotives

Delaware & Hudson's 31 years of one-man rule sired unorthodox steam power of a Continental concept

BY DAVID P. MORGAN

To assert that the steam locomotives of the Delaware & Hudson were daring in design and austere in appearance is to say they were cast after the character of the man who ruled the road for 31 tumultuous years: Leonor Fresnel Loree. Like his engines, Loree was a stark model of efficiency — a great and proud figure of a man who believed in flat profiles and super locomotives, a day's work for a day's pay, discipline of organization and freedom of management. It has been remarked that he lacked the imagination of a Cassatt; certainly he was without the tact of a Willard. He had a voice whose thunder awed capital and labor alike, a final and dogmatic tongue that as early as 1923 derided top-heavy Federal regulation with the premise that "railroading is no longer a business, it is a calamity," and defined Soviet Russia as a "nightmare of Utopian intoxication."

Loree was a firecracker with a flair for upsetting the best laid plans of mice and men. "While yet but a junior engineer on the Pennsylvania," *Railway Age* has said, "he prepared a criticism of plans that had been sent out from the chief engineer's office for the construction of a yard. This stroke

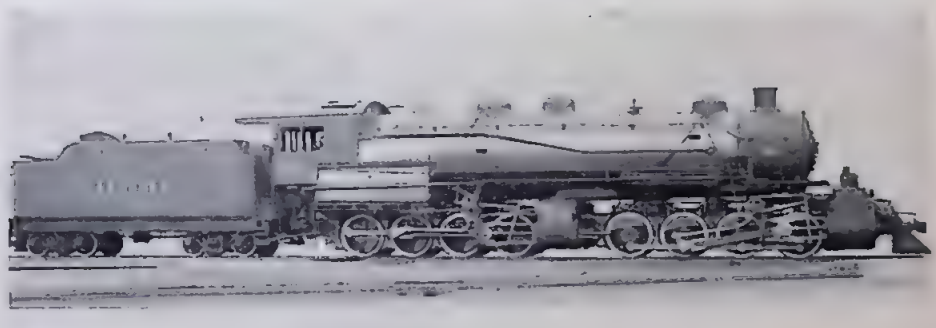
Rail Photo Service: W. G. Fancher.

Along the shore of Lake Champlain and south of Port Henry, N. Y., elephant-eared 4-8-4 No. 303 rouses the hills with militant stack music as she hits an ascending grade with the loaded hoppers of southbound symbol freight SW-4.

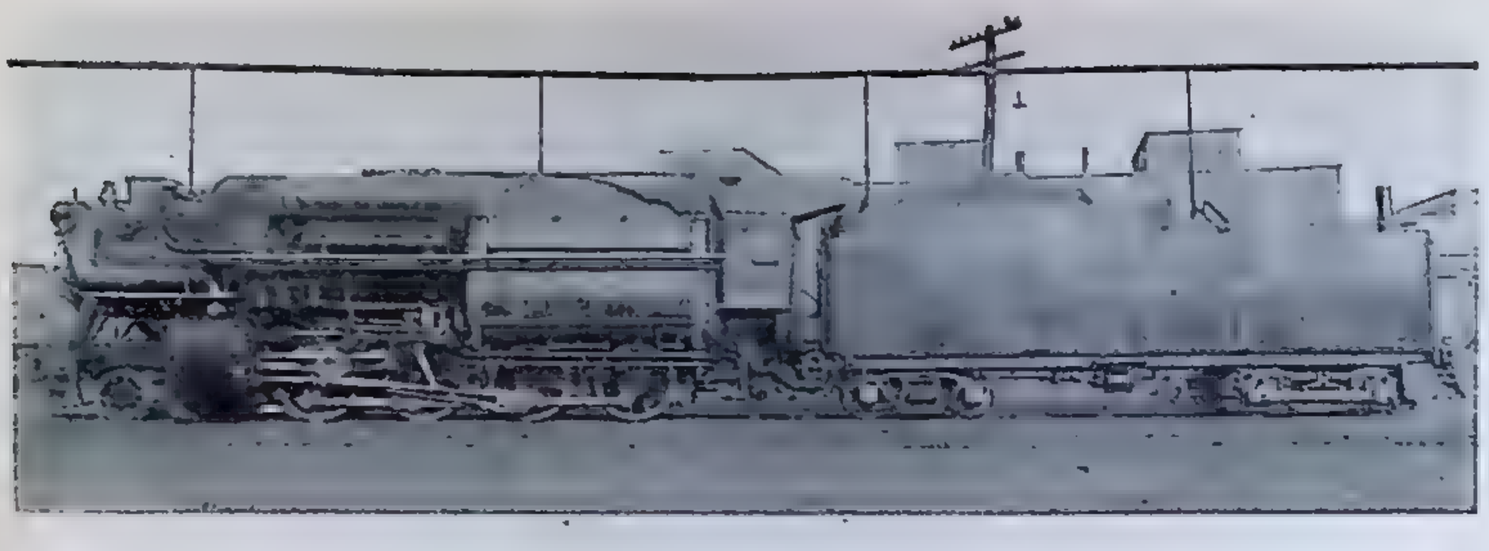
of boldness gained not suppression from above, but close attention to his contentions; and the yard was built according to his ideas." Broad Street headquarters liked the look of the man who dared to question. He strode into the ravages of the 1886 floods in Ohio and returned seven miles of track, two trestles, three stone arch culverts and 26 iron bridges to service within six days. For tactics like these he was named general manager of Pennsylvania's Lines West at the age of 38. For Loree that was a lower rung on the ladder.

He became, successively, president of three railroads, chairman of two more, and a director in six others. Trained as an engineer, he earned

When Leonor Fresnel Loree accepted the presidency of the D&H in 1907, the anthracite roads were still married to the theory that they couldn't mount a cab on the back end of a wide Wootten firebox and expect the engineer to see ahead. D&H moved its tonnage then with Alco Mother Hubbards like No. 793↑, built in 1903. During the years 1926-30 Colonie Shops completely rebuilt 35 such E-3a class 2-8-0's↓ with single cabs, Walschaerts gear and piston valve cylinders. Higher boiler pressure jacked up tractive effort from 38,150 pounds to 50,600 pounds.



When the original H-class 0-8-8-0 Mallets↑ were delivered to the D&H in 1910, they were the most powerful locomotives ever built. Employed as pushers, the Alco compounds were patterned after the Erie's Mother Hubbards of the same wheel arrangement. Seven H's, like No. 1610↙, were subsequently rebuilt at the Colonie Shops with higher drivers and one-piece cast steel engine beds with cylinders cast integral. External refinements included elimination of two domes and extraneous piping. Larger tanks and modified cabs also aided appearance of rebuilds.



The Horatio Allen, first of the experimental E-71 class Consolidations, exerted a starting tractive effort of 105,500 pounds in simple gear with booster cut in. The cross-compound Allen carried boiler pressure at 350 pounds; cylinders were controlled by Young valve gear.

The John B. Jervis of 1927 was practically a twin brother of the Allen; differences included slightly smaller cylinders balanced by a higher boiler pressure of 400 pounds, a larger tank, and Walschaerts gear. Semistreamlined jacket later covered up No. 1401's nightmarish nose.

recognition as an operating man and graduated as a senior statesman of the industry. He was at once an inventor (upper quadrant semaphore signal and lap passing siding), a writer (*Railroad Freight Transportation*), and a strategist (an advocate of voluntary mergers, he knocked the I.C.C.'s Eastern District four-system consolidation plan off balance in 1925 by proposing a fifth system to include a brand-new, low-grade route across central Pennsylvania).

The bewhiskered, uncompromising, notoriously capable Loree took the throttle of the Delaware & Hudson in 1907 upon the advice of his close friend, E. H. Harriman. From then until his retirement in 1938 the anthracite hauler was a one-man show, a test tube bubbling with all that Loree stood for and against. It was an iron-handed reign headlined by the development of a high-capacity, low-cost transportation plant which earned a steady 9 per cent return on investment for stockholders until the depression — and which was punctuated by constant friction with organized labor, shrewd maneuvering during the consolidation movement, periodic squabbles with various Government regulatory bodies, and bold experimentation ranging from high-pressure boilers to welded rail. Because of Loree, the company achieved a rank out of all proportion to its modest mileage.

The locomotives purchased or rebuilt throughout Loree's administration mirrored its trials and triumphs. Often experimental in concept, always disciplined in design, they ran the gamut from high-pressure 2-8-0's to Pacifics with rotary cam poppet valve gear and recessed headlights. They seldom agreed with contemporary U. S. engineering and yet they included the first driving-axle and side-rod roller bearing assemblies, tender booster and welded boiler. The industry learned to look when the D&H unwrapped a new engine because Leonor Loree was a man well versed in locomotives. In Mallets, for instance.

Before he became president of the Baltimore & Ohio in 1901, Loree rode a Fairlie 0-6-6-0 up the 4 per cent grades of the Mexican Railway. Impressed, he began to gather data on the Mallet type articulateds being operated in Switzerland and Russia. The proposition was handed to General Superintendent of Motive Power John E. Muhfeld, who went into a huddle with the American Locomotive Company. The Loree brainchild they built — a compound 0-6-6-0 — introduced the Mallet to America, astonished the crowds at the St. Louis Exposition in 1904, and thereafter replaced the two Consolidations which had previously assisted freight trains up B&O's Sand Patch grade.

Early in his regime Loree found another Sand Patch on the D&H: 19 miles of curving, climbing main line out of Carbondale, Pa., with a ruling grade of 1.3 per cent. It was all that three of the road's newest and most powerful 2-8-0's could do to pull and push 2600 tons up to the summit at Ararat, though a single engine could forward a train of that size over the 76 miles beyond into Oneonta, N. Y. Arrangements were made to borrow an Erie Mallet for comparative tests. One fall day in 1909 a Mother Hubbard 0-8-8-0 compound lumbered into Carbondale, shouldered the double-headed 2-8-0 pushers aside, and began to heave in the direction of Ararat. According to a *Railway Age Gazette* report, the big Erie "easily did the work."

In 1910 the American Locomotive Company delivered six 0-8-8-0's to the D&H; they were the most powerful locomotives ever built and at one stroke they replaced a pusher pool of 12 heavy Consolidations. Their success warranted the addition of seven similar but superheated Mallets to the roster in 1911-1912.

But aside from these articulateds, and 10 Pacifics installed on the Montreal night trains in 1914, the Delaware & Hudson refused to follow a national trend toward engines with trailing trucks and more drivers. The primary function of the railroad was the movement of anthracite in tonnage drags, an operation in which speed was considered an unessential and uneconomical element. The company's heavy rail and bridges made the addition of more axles for weight distribution purposes unnecessary. Consequently, D&H went right on developing enormously large 2-8-0's (a practice also adhered to by such adjacent coal carriers as the Lehigh & Hudson River, Lehigh & New England, and Reading). Federal control during World War I had no influence

The James Archbald, outshopped by Alco in 1930, carried pressure at 500 pounds, sat on 63-inch instead of 57-inch drivers, and featured outboard pony truck journals and a recessed headlight. Like the other E-71's, No. 1402 was a cross-compound, used her high-heat steam twice.

The L. F. Loree of 1933 — biggest and most remarkable of all D&H's designs — was an opposed-cylinder 4-8-0, a triple-expansion locomotive with rotary cam poppet valve gear. Crosshead crank actuated feedwater heater. No. 1403 was displayed at Chicago Century of Progress.

upon this policy because standardized U.S.R.A. locomotives were not allocated to the D&H inasmuch as their comparatively narrow fireboxes could not burn small anthracite.

The Loree administration resumed its classic aloofness on all matters of motive power once the railroad was returned to private management. The mechanical department housed in the chateaulike headquarters at Albany, N. Y., kept its own counsel and looked to Europe for inspiration. Alco's three-cylinder bender, Lima's "Super-Power" philosophy, a score of fresh wheel arrangements sired by the four-wheel trailing truck — these and other developments never got past a knock on the door at Albany.

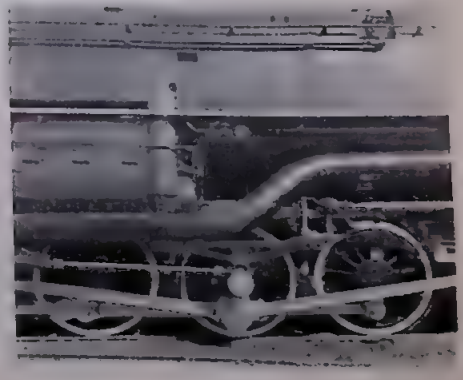
Alco (the only builder which D&H ever patronized) constructed only four engines for the road from 1918 to 1940, and each of these was an experimental. The handful of new locomotives which the road did acquire between wars, 14 Consolidations and 3 Pacifics, were all built in its own Colonie Shops, 4½ miles north of Albany. As opposed to the common practice of replacing and supplementing its older power, D&H began, in 1924, to modernize it. When an engine came due for frame renewal it was tagged for a sojourn at Colonie. There center-cab Mother Hubbards lost their humpbacks, saturated power was souped up with superheaters, Stephenson link motion and "D" valves were exchanged for new enlarged piston valve cylinder blocks and Walschaerts gear, and operating boiler pressures were jacked up. Over 100 locomotives were thus mechanically refurbished throughout the period 1924-1936; they ranged in size from American Standards to Mallets and they included a considerable number of light and heavy Consolidations which cashed in their pony trucks to become 0-8-0 yard engines.

In appearance these rebuilds were free of extraneous pumps and piping, a condition which, together with their wide and fan-shaped fireboxes, rendered some of them austere to the point of being ugly. In performance they were quite satisfactory. The rating for one class of medium 2-8-0 northbound from Wilkes-Barre, Pa., to Oneonta, N. Y., for example, was raised from 2250 to 2600 tons following modernization.

An extra stimulus to tractive effort was the tender booster, a gadget of the D&H's own devising. The booster was a midget two-cylinder steam engine mounted on the rear truck of the tender and geared to one of its axles. It received steam through a pipe attached to the one which fed the left steam chest of the locomotive and exhausted it into the tank (thus serving as a junior feedwater heater). The device had a special appeal for the D&H since it operated no engines equipped with trailing trucks, the more common location for a booster. As first installed beneath the tender of Mother Hubbard 2-8-0 No. 901 in 1922, the booster worked wonders. The engine handled a 2477-ton test train over a grade on which she had formerly been rated for 1650 tons, and she performed with equal facility on the hump at Oneonta Yard. Of all the steam locomotive improvements pioneered by the D&H — excepting roller bearings — the tender booster was the most widely duplicated. It was manufactured in quantity and became a familiar sight across the nation — especially on humps.

Loree was still goaded by a relentless ambition to lower the cost of transportation. To satisfy his urge he summoned the man who had conquered Sand Patch: John Muhfeld, by then a consulting engineer. Together they mulled over a seesaw problem in locomotive economics — how to boost tractive effort and cut coal consumption. To simplify the issue they selected the 2-8-0 wheel ar-

All four of the Loree's cylinders drove on the second driving axle, which was equipped with roller bearings as were main and side rod bearings of the 4-8-0's main crank pin.



A narrow gauge boomer

M. W. Swanstck.

When the Rocky Mountain Railroad Club — one of the most aggressive rail enthusiast groups in the nation — scheduled an excursion over the Rio Grande Southern in late May, 1949, it specifically requested that No. 74 be assigned to the special train. Management, though fearful that the 2-8-0 might not make the grades, reluctantly agreed, making this photo possible. Here No. 74 stands with the special at Pandora Basin.

DATA FROM JOHN W. MAXWELL

THE narrow gauge Brooks Consolidation illustrated on these two pages has miraculously managed to achieve an age of 52 years without resort to either the kindness of a museum manager or the good graces of the Chicago Railroad Fair. In spite of hard times and receiverships, line abandonments and a wartime scrap drive, this 2-8-0 has piled up a seniority more than twice that of many standard gauge Mikes and Mountains now meeting diesel deadlines in scrap yards from Pennsy's Conway Yard to Hayne Yard on the Southern Railway.

No. 74, her present designation on the Rio Grande Southern roster, has encountered no worry from diesels, but almost every other brand of trouble has been her lot since she was turned out in 1898 for the Colorado & North Western Railway. Deficits as high as $38,000 a year began to pile up and the C&NW slid into receivership, emerging in reorganization by 1904. Three years later the same sad situation was in effect, the road coming out of bankruptcy as the Denver, Boulder & Western ("The Switzerland Trail of America") in March of 1909. Line washouts and permission to discontinue operation came simultaneously to this mountain-railway-without-tunnels in 1919. The Brooks 2-8-0 (DB&W No. 30) then went with Nos. 31 and 32 to Morse Brothers, Denver dealers in secondhand locomotives.

In 1921 the Colorado & Southern (very much in the three-foot business at that time) exchanged five of its older 2-8-0's for the three DB&W engines. Renumbered 74, ex-No. 30 gave the C&S some trouble with her large, outside valves for her Stephenson gear (her two sisters had inside valves), so Walschaerts gear was applied in early 1926. This expenditure cured No. 74's machinery complaint; from then on she pounded up and down South Platte Canyon in a satisfactory manner.

In 1938 the C&S ripped up its slim gauge iron except for a short, lonely stretch of line from Leadville to Climax. And that was standard-gauged in August, 1943. No. 74 was stored by the C&S for a time, then sent back to Morse Brothers.

In November, 1948 — after No. 74 had rusted in storage for over five years — the Rio Grande Southern paid a reported $3,000 for the 2-8-0 and took her to Durango as a Christmas present.

Colorado & North Western No. 30

Denver, Boulder & Western No. 30

Colorado & Southern No. 74

Rio Grande Southern No. 74

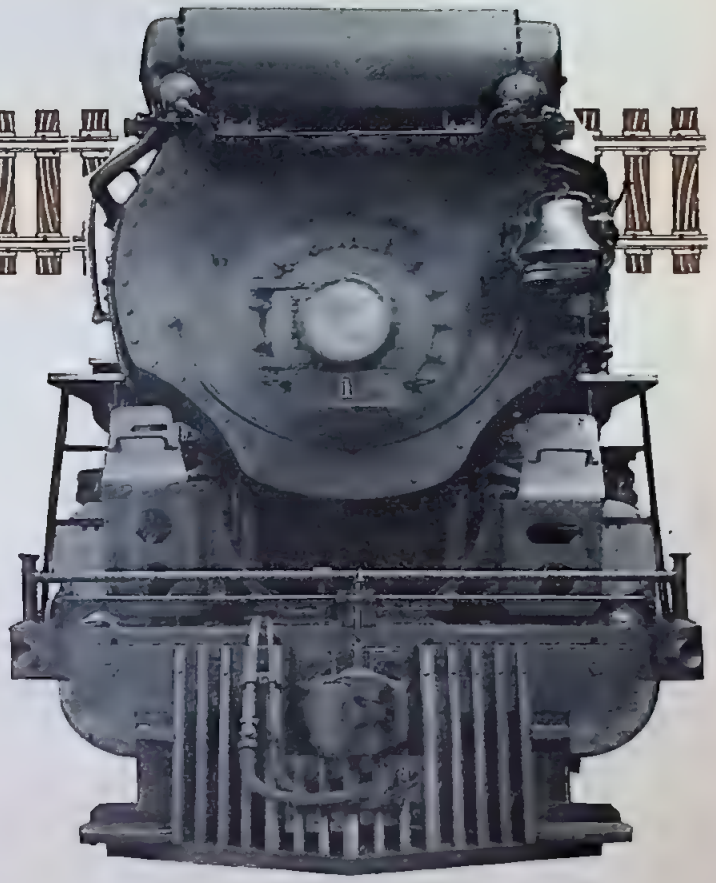
All photos from John W. Maxwell.

W. E. Malloy Jr.

Portrait of Super-Power: Southern Pacific's Lima-built GS-4 No. 4453 storms up through Pasaro Canyon with the westbound Morning Daylight for San Francisco. The double-headlighted 4-8-4 is one of a fleet of 60 such streamlined locomotives which the Lima Locomotive Works designed and constructed for the Espee between 1936 and 1943. They became the system's standard heavy steam passenger power.

The Lima story: 1

SUPER-POWER



How the youngest builder in the nation turned out the most important steam locomotive of the century

BY DAVID P. MORGAN

IF you hail a cab in Lima, O., today and give the driver the most famous address in town, she'll lift the radio mike off the dash and report to the fleet dispatcher:

"Going out to the 'Loco.'"

Only it isn't the "Loco" any more. Nor is it THE LIMA LOCOMOTIVE WORKS, as the engraved stone over the doors of the office building announces. It's just a factory where they manufacture cranes and shovels and work on military contracts behind doors marked "Restricted." No cast steel engine beds are spotted on the production line and no boilers are being swathed in white magnesia blocks. The overhead cranes are not lowering any diesel engines onto the frames of road-switchers nor are any freshly painted traction motors awaiting truck assembly. There are just cranes and shovels and products the Defense Department won't let you write about.

But here and there on the walls of the drafting offices at the "Loco" you find framed pictures of locomotives: a diesel yard engine, a 2-8-4, a streamlined Northern. Eventually someone locates a key and unlocks the door of the board room on the first floor. On the wall at the foot of the chair-lined oak table is a huge photograph of a Chesapeake & Ohio 2-6-6-6 simple articulated. The 549-ton locomotive (and tender) was the largest single product ever constructed by the "Loco." There is a dinosaurian quality about the picture in the board room today: the Allegheny type is a member of a race slated for extinction and the corporation that designed and built her no longer has its shares listed on the big board of the New York Stock Exchange. Lima is just an outlying factory of a company with headquarters in Philadelphia, and the board room table and chairs have a film of dust upon them.

THE firm which engineered C&O's H-8 articulated got into the locomotive business as unobtrusively as Electro-Motive, the GM division that was actually responsible for Lima's getting out of the same trade. In 1879 it was a Lima machine shop doing a lucrative business in "direct-acting circular saws" for the lumber industry, with an agricultural sideline of mowers, reapers, threshers and plows. In 1879 the buzz saw of the Lima Machine Works was the loggers' best friend, but it only felled the trees — it could not drag them out of the forests. Teams of mules and horses did that and they also swallowed up the lumberman's profit. Crude railways with wooden rails helped out in the cold mud of winter, but on a descending grade the trucks of logs, with no braking power, would break away and maim or kill the animals. Small steam locomotives were a poor solution because they derailed too easily on the homemade track.

The machine shop built three locomotives that year for the J. Alley Company, presumably a logging outfit. Earle Davis, writing in *Railroad Magazine,* called the first of this trio a Shay while Lima itself thinks all of them were direct-drive engines. The big green record book of the plant identifies No. 1 as a Shay of the "Fontaine type." The historian of today can assume that both Davis and Lima are partially correct, that No. 1 was a half-breed, a cross between a rod and a geared engine. It is known definitely, however, that a genuine Shay type locomotive was built by Lima in 1880 to the patented plans of Ephraim Shay, a white-haired old Michigan lumberman with a flowing mustache and an undisciplined beard.

E. Shay, as he signed himself, was quite an inventor. Prior to the geared locomotive he had figured out a propeller that could steer a boat and eliminate its rudder and he had done some heavy thinking about subma-

J. B. Allen; collection of C. W. Witbeck.

The A-1, Lima's precedent-breaking 2-8-4, is still going strong as the Illinois Central's No. 8049, even though her Elesco feedwater heater is absent and her air pump shields are missing. The squared sand dome, introduced by the big Berkshire, eventually became a standard part on all IC power.

Woodard, a Cornell graduate who had learned about locomotives on the payrolls of Baldwin, Dickson, Schenectady and Alco; he was one of the designers imported by Coffin and Allen. The plan on the desk before him detailed a 2-8-2 with a fat boiler. It was unlike any engine taking shape in the shops behind Woodard's office. In point of fact, it was unlike any other engine anywhere.

Once Will Woodard had completed his blueprints, the cost of the Mike was budgeted on the company's own expense account and work was begun. The last jacket sheet was secure in May 1922, and the company photographer was called in for a picture. The locomotive he saw had, as *Railway Age* phrased it, "a striking appearance." She had a fierce, almost ugly look suggested by an Elesco feedwater heater hung ahead of the stack and an outside dry pipe along the boiler top that took steam from the dome to the front-end throttle. The Delta trailing truck that supported the extra-big firebox mounted a booster. And there was a lip on her stack.

Even more startling than her enormous look were her statistics. Woodard had purposely designed the 2-8-2 so that she would not exceed the axle loadings of a Michigan Central H-7e, the NYC subsidiary's newest and finest Mikado. He had also engineered her to (1) deliver more power for her weight than any other engine ever built and (2) to do it on less coal. No. 8000, as the Woodard engine was numbered, was slated to go into immediate service on the Michigan Central. It is understandable that President Alfred H. Smith of the New York Central took a personal interest in the 8000's progress and was on hand to give her a pre-service inspection.

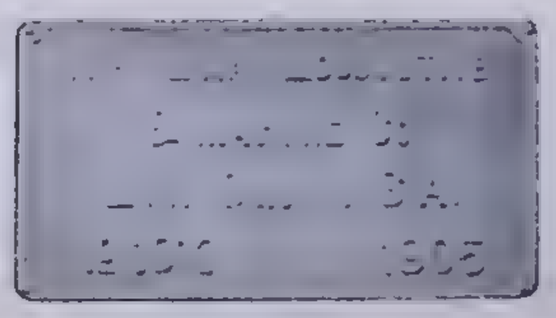
Few, if any, new locomotives ever sold themselves more quickly. No. 8000 had been on the road little more than a month when the New York Central ordered 150 duplicates. The H-7e, with which she was compared, was considered a "very well designed Mikado." The 8000 outperformed the H-7e in every department. Notwithstanding an increased weight of less than 2 per cent, the Lima locomotive developed 17 per cent more indicated cylinder horsepower and reduced rail pound by over 42 per cent. *Railway Review* considered her coal and water economy "phenomenal." In tests between Detroit and Toledo the MC kept adding cars until one day the 8000 walked across the division with 10,039 tons behind her tank. New York Central classified the 8000 as its H-10 and by the end of 1924 had over 300.

Woodard's fat 2-8-2 was a demarcation point in American locomotive design. Instead of merely adding more drivers and more weight, he added a booster to obtain more starting power. That left him free to concentrate on horsepower. Woodard had sought an engine that would not run out of steam at 35 or 40 miles an hour (as 2-10-2's had an unhappy habit of doing) or require excessive rates of firing. Subordinate to these aims was a sheaf of minor refinements that added up to more engine and less bulk, improvements like the use of superheated steam for all auxiliaries, hollow axles to save weight, lighter rods to cut down on dynamic augment, and stack exhaust for the booster engine to improve boiler draft at low speeds.

Woodard was pleased with the way the 8000 handled herself on the Michigan Central. But he was not satisfied. He never was.

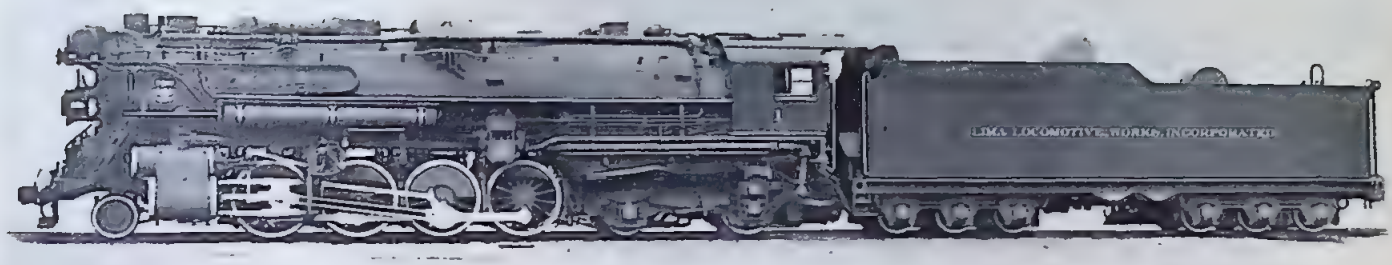
New York Central cooperated by running a series of starting and acceleration tests at Ashtabula, O., in 1923 and also supplied the results of its invaluable boiler tests conducted at Gardenville, N. Y. Woodard then obtained the bulletins of the Pennsylvania Railroad's Altoona test plant. Thus armed, he sat down at his desk and set himself a problem. Could a locomotive be designed that burned 20 per cent less coal than the 8000 in drag service and 12 per cent less in fast freight operation? Or an engine that developed 10 per cent more drawbar pull for the same fuel?

By late 1924 Will Woodard had his super locomotive down on paper and the forges and lathes were hammering and cutting it out of new steel — again at company expense. Early the next year the A-1, as she'd been dubbed by



the works, poked her nose outside the paint shop. She looked like an 8000 that had gone to college, for in addition to an Elesco feedwater heater mounted up front she wore shield air pumps on her pilot, footboards, and a bell on her left cheek. She had a long, large smokebox and a sizable boiler — but behind it all was an enormous firebox supported by a four-wheel trailer truck equipped with a booster. Indeed, as the spectators noted, she was a 2-8-4, a brand-new wheel arrangement.

The A-1 was Woodard's horsepower freight hauler with no holds barred.



The most successful demonstrator ever built as she looked when new at Lima in 1925. While the engine was originally fitted with footboards, a temporary wooden pilot (as shown on page 13) was applied for road tests. Firebox was so large that it necessitated the use of a four-wheel trailer.

A cross-check of her dimensions with those of the 8000 clearly indicated the basic philosophy of Woodard's engineering. Weight on drivers exceeded that of the Mike by a mere 200 pounds while the weight on the rear truck was nearly doubled. Size of cylinders and drivers was identical. The A-1, without her booster cut in, had only slightly more tractive effort, while her factor of adhesion was actually a trifle less. But while the 2-8-2 had 291 square feet of firebox heating surface (including arch tubes), the 2-8-4 had 337. The A-1's 100 square feet of grate area was unmatched by any conventional nonarticulated of that period; even the Virginian's 2-10-10-2 could boast of only 108.7 square feet. The result was a locomotive that delivered her power to the rail in approximately the same manner as the Mike of 1922—except that the new engine could produce far more of that power.

The painstaking refinement of subordinate parts — rapidly becoming a trademark of Lima — was exemplified all over the A-1. The use of cast steel cylinders (an idea first employed on Alco's 50000 by Francis J. Cole, Woodard's old tutor) saved 4000 pounds of dead weight. To absorb the increased thrust of more horsepower there were tandem rods which placed their load on two axles and four crank pins. An articulated rear truck permitted a bigger ash pan. And there was a gimmick labeled "limited compensated cutoff." This meant that instead of working full stroke when starting (with the reverse all the way over into the front or "company" notch), the A-1 worked at 60 per cent cutoff. The idea has since been described as "an insurance against the engineer working at full stroke without necessity and thereby burning excessive coal." To compensate for a certain drop in starting power, the A-1 steamed at 240 pounds pressure instead of 210 as on the 8000. The design of the cylinders was also adjusted to provide slightly larger intake ports on the front end at low speeds.

On February 18, 1925, the 2-8-4 showed up at the Selkirk (N. Y.) roundhouse of the Boston & Albany and was promptly broken in on a few freight trains. Then the West Springfield Shops mounted a wooden wind screen on her pilot (to protect technicians taking cylinder readings at speed), coupled her up to NYC dynamometer car No. X-8006, and sent her out into the Berkshires. For a month and a half the one-spot's performance through New York and Massachusetts was translated into a mass of cylinder cards, tapes and graphs. Then on April 18 she made a run that caused immediate and wide-eyed comment in the pages of the trade press.

At 10:57 that morning B&A Mikado No. 190, an H-10 sister of the 8000, cleared Selkirk Yard eastbound with 1691 tons. At 11:44 the A-1 departed with 2296 tons in tow and began to steadily narrow the gap between the two freights. Out of Chatham both trains were running on multiple track, and at approximately 1 p. m. the 2-8-4 gradually overhauled the laboring Mike and left her behind. She was into North Adams Junction at 2:02, just 10 minutes ahead of the Mike and after 46 miles on the road since Selkirk. Horsepower had paid off.

After her B&A trials were completed, the A-1 piled up more mileage on seven other roads, including the New York Central, Missouri Pacific and Illinois Central. She even hauled the Milwaukee Road's *Pioneer Limited* into Chicago.

As a wheel arrangement, the A-1 was both a pioneer and a salesman. More than 600 Berkshires were turned out for service in the U. S. and Canada; of that number Lima built 355 while Alco, Baldwin and Montreal divided up the remaining 253.

As a flagbearer of the horsepower age, the A-1 had an even greater impact upon the American railroad scene. It is necessary to recall that when she was running road tests Alco was busy peddling three-cylinder engines and Baldwin was building a watertube-boilered compound 4-10-2, also with three cylinders. Elsewhere, Delaware & Hudson's high-pressure drag engines were raising eyebrows. There was admittedly much of boiler and machinery merit in all of these locomotives, but there was not a true horsepower engine among the lot. In 1925 Lima was the only spokesman for what it termed "Super-Power" locomotives — locomotives with great steaming capacity at speed. Eventually the railroads themselves gave the decision to Super-Power. Baldwin's 4-10-2 was parked in a museum, D&H's ponderous experimentals were scrapped, and orders for three-cylinder power played out. The engines that pulled the roads out of the depression were Hudsons and Berkshires and 4-8-4's and 2-10-4's — engines built upon the Super-Power principles laid down by the A-1 in 1925. No other steam locomotive since the First World War had a comparable effect upon the industry. It is significant to observe that the last new steam engines produced by both Alco and Lima were 2-8-4's.

And the engine that put Lima in the big time? Today the A-1 is No. 8049 on the roster of the Illinois Central, working in a freight pool out

of Memphis to Bluford, Ill., and Paducah, Ky.

THE A-1 was not the only achievement that Lima Locomotive crowded into that momentous year of 1925. It also built the first engines of a fleet of 70 Texas & Pacific 2-10-4's. The Texas type was the first ten-coupled locomotive with a firebox so large that it required a four-wheel trailing truck, and it thoroughly outperformed T&P's 2-10-2 in tonnage, speed and economy. The fame of Super-Power spread from railroad to railroad and it became a standard topic of discussion at all mechanical conventions. Page after page of feature space was devoted to it in the trade journals and not a few editorials were written in its favor.

Among the railroads which had been impressed by all this beating of drums was the Chesapeake & Ohio. At that

time it was working 10,500-ton coal trains north from Russell, Ky., to Columbus, O., behind large 2-8-8-2 simple articulateds. The trains were broken up in Columbus and dispatched beyond to Toledo behind either Mallets or 2-10-2's. C&O wondered if a Super-Power locomotive could eliminate the engine change and possibly get over the road in less time. To that end it borrowed an Erie S-3 Berkshire with 70-inch drivers (not a difficult transaction in 1929, when both roads were under the thumbs of the Van Sweringen brothers).

C&O shops boosted the S-3's boiler pressure and added a little weight to its drivers. Then the locomotive was put through her paces. The Erie engine, which was a Baldwin, incidentally, turned in a good day's work though she was not an equal of the articulated in sheer pulling power. After examining her dynamometer car readings the C&O decided that the engine it wanted should have the 70-inch drivers of the S-3 but considerably more power and a bigger tender. And since it felt that it would be "impossible to provide sufficient boiler capacity with driving wheels of increased diameter on an articulated locomotive" (a conclusion Lima later disproved with Allegheny type 2-6-6-6's), it ordered 40 Texas types from Lima in 1930. Among other considerations, the shorter length of a 2-10-4 would permit it to have a longer tank and still fit the turntables that accommodated the articulateds.

The Chesapeake & Ohio T-1, when delivered, was the most powerful two-cylinder locomotive in the world. Her debut on the road, running through without change from Russell to Toledo, indicated as much. She more than met the tonnage requirements and she managed that feat on 14 per cent less coal. The H-7a articulated that the 2-10-4 replaced was only four years old at the time and was considered an excellent design. Licking such a sixteen-drivered engine on its home ground with a ten-coupled unit was the final vindication of Will Woodard's Super-Power. More than ten years later the T-1 still bulked big in the motive power world. During World War II the Pennsylvania selected it from among many good designs when War Production Board restrictions prohibited an original PRR blueprint. Lima draftsmen redrew its plans for construction as the Pennsy J-1, though the 125 Texas types the road acquired were built by Altoona and Baldwin. To this day certain responsible parties assert that the Pennsylvania never owned a better steam locomotive.

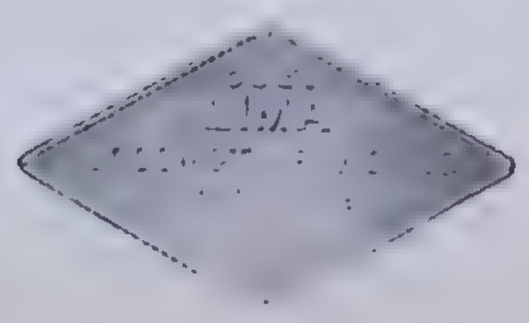
THE C&O engines were among the last big steam orders that Lima filled before the depression closed up its plant. The only work that kept it open into 1932 was a Pennsylvania order for the Works' first and only electric contract: the construction of cabs and running gear for 30 box-cab 2-8-2's. For many months after their construction these motors, which General Electric was to have fitted with electrical equipment, sat behind the Works in sheds. Eventually all were shipped to the PRR and scrapped shortly thereafter. Presumably by that time the GG-1 had been adopted instead.

Once the electrics were completed, Lima paid off its workers and locked up its buildings; only a handful of designers and office personnel were left on the payroll. The next new locomotive did not leave the plant until May 3, 1934. There was a year-to-year net deficit during those times but the company was in sound financial shape to take the stress. It had no bonded debt, no bank loans, and only one class of stock. Joel Coffin, the man whose salesmanship and organizational ability had done so much for Lima, died in 1935.

At last the railroads picked themselves off the floor of the stock exchange and a few orders trickled into Lima. Furloughed employees were recalled from the farms surrounding the city, and fire again burned beneath the forges. A batch of beautiful Boston & Maine Pacifics were shipped east while the Detroit, Toledo & Ironton (which operates through Lima) took four 2-8-4's. Something of a record was established in the construction of C&O's first 4-8-4's: an order for five such engines was received on July 10, 1935, and the first of them — the *Thomas Jefferson* — was sent out of the Works on December 11.

The locomotives that created the most excitement around the shops in those prewar years were the GS-2 class 4-8-4's for the Southern Pacific. The biggest railroad in the West (a region where not a single Super-Power engine had been sold) wanted six streamlined Northerns for a swank new coach train to be called the *Daylight*. Lima itself styled the handsome dress of the red-orange-black locomotives with a broad skirt and a "skyline casing" over the domes from the stack to the cab. The top casing also made an admirable smoke lifter and the Espee eventually rebuilt most of its heavy Pacifics and Mountains with it.

The GS-2 acquitted herself nobly over the California Coast Range between San Francisco and Los Angeles and the road immediately placed a repeat order for an 80-inch drivered version. In the years that followed, Espee acquired a fleet of 60 Lima-



built *Daylights* and they became its standard heavy-duty passenger power. The miles they rolled and the trains they pulled during the war are legend across the Far West. One of them, GS-4 No. 4459, managed to squeeze over a million miles into her first eight years of service, a fact which earned considerable publicity for the makers of her SKF roller bearings.

In 1939 Lima added to its Espee laurels by building the road's heaviest steam power, a dozen 2-8-8-4's. These engines, called the only "semistreamlined articulateds" because of their skyline casings, slightly outweighed the system's more famous cab-in-fronters.

ELEVEN years after Lima Locomotive built the Chesapeake & Ohio T-1, the plant constructed the articulated that the road had deemed impossible in 1930. The new Allegheny type, be-

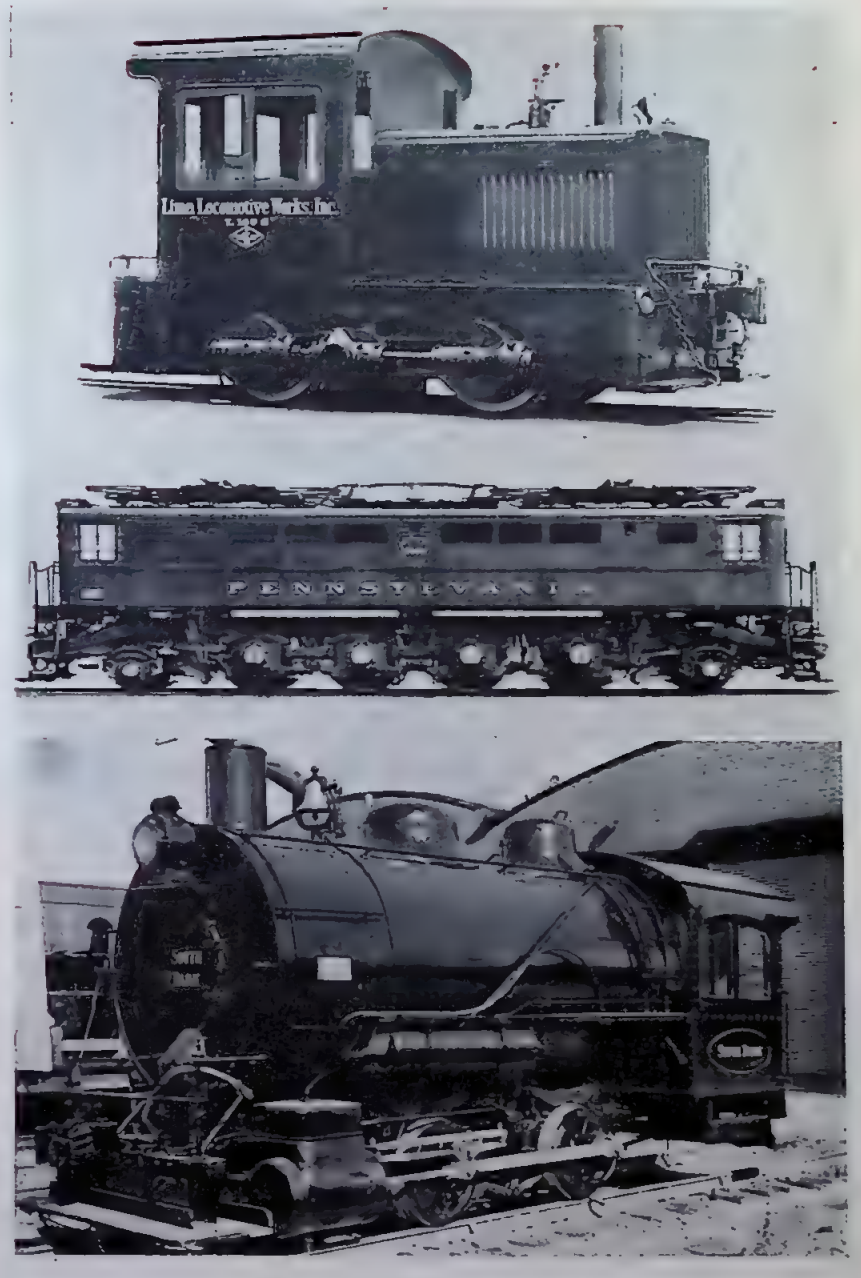
ing a Lima design, naturally carried a big firebox. It was so large (135.2 square feet of grate area) that it required a six-wheel trailer truck, rendering the H-8 a 2-6-6-6. For an articulated, the new engine was remarkably trim and compact. She was also the largest locomotive ever built by Lima. Once she hit the road there was reason to recall Ephraim Shay's remark about her builder — "they put more brains in their work. . . ." The H-8's performed yeoman service over the mountains as both road engines and helpers and they were also used to supplement T-1's between Russell and Toledo. One of them ran dynamometer tests on the latter line — tests that Lima hurriedly made public. The graphs indicated a maximum drawbar horsepower of 7498 with frequent readings between 6700 and 6900 in the 42-to-46-mile-an-hour bracket. The 2-6-6-6 was purposely stopped with a 160-car, 14,083-ton coal drag on a level, tangent line for an acceleration test. The Allegheny was moving 19 miles an hour within a space of one mile and within 6 minutes; five minutes later she had the bituminous coal rolling along at 29 miles an hour.

Lima built 60 of the Super-Power articulateds for the C&O and there is talk that the road wishes it had ordered more of them before Lima closed up its order books in 1951.

Lima's last great stand was the Second World War. It built a factory for the production of tanks, and employment was doubled to reach a peak of over 4000 men and women. Its normal business was swelled by the railroads' critical need of more and more new locomotives — smoke-deflectored Mohawks for the Central, additional Espee GS's, C&O articulateds. But orders from the War Department dwarfed these large common carrier contracts. Somehow the Works contrived to outshop 661 2-8-0's (more than all the Berkshires ever built), 70 Mikes and 37 six-coupled switchers for overseas shipment. In one month 40 locomotives were turned out. In those days Lima had more locomotives than Carter had little liver pills.

As the war relaxed its grip upon the Continent and the Far East, Lima shifted to the production of power for peace. Some 280 smoke-deflectored Mikados were built for the French National Railways. Two lots of locomotives were shipped that later fell prey to the Communists: 20 Republic of Poland 2-10-0's and 45 Consolidations under the U.N.R.R.A. program for China. And there was on contract for a nonbelligerent, a set of 14 Belpaire-boilered 4-6-2's for Argentina.

The company came out of that peak



Lima's black sheep

THESE are the locomotives that Lima would just as soon not talk about today. The vest-pocket direct-drive gas unit at top was the 100-horsepower version of a switcher using Shay bevel gears. Lima also built a 200-horsepower engine of this type in the late 1920's, but neither one warranted further production. The box-cab electric 2-8-2 in the center is Pennsylvania No. 5940, one of 30 such motors for which Lima built the cabs and running gear. General Electric was to have completed the locomotives, but all were scrapped before seeing any service. The diminutive 0-4-0 is Lima's only fireless "cooker," a switcher minus a firebox and dependent upon a factory power plant for her steam supply. Though built in 1910, "South Park" has the distinction of being the last steam locomotive to leave the Lima erection hall — her owner, National Cash Register of Dayton, sent her back for repairs in October 1950.

production period as confident as ever of steam and what it could do for the railroads. Albert J. Townsend, its able vice-president of engineering, waded into an enormous research program while the shops filled orders for new 2-8-4's, the old sales stand-by. It was announced in 1946 that Lima had patented a double-Belpaire boiler. Townsend combined it with Franklin rotary-cam poppet valves (Lima had rebuilt a Pennsylvania K-4 with poppets back in 1939) to create the company's postwar design, and went knocking on the railroads' doors for a buyer. There was a healthy chance that the diesel boom could be checked, and Lima's advertising indicated that the Works would not give up without a fight.

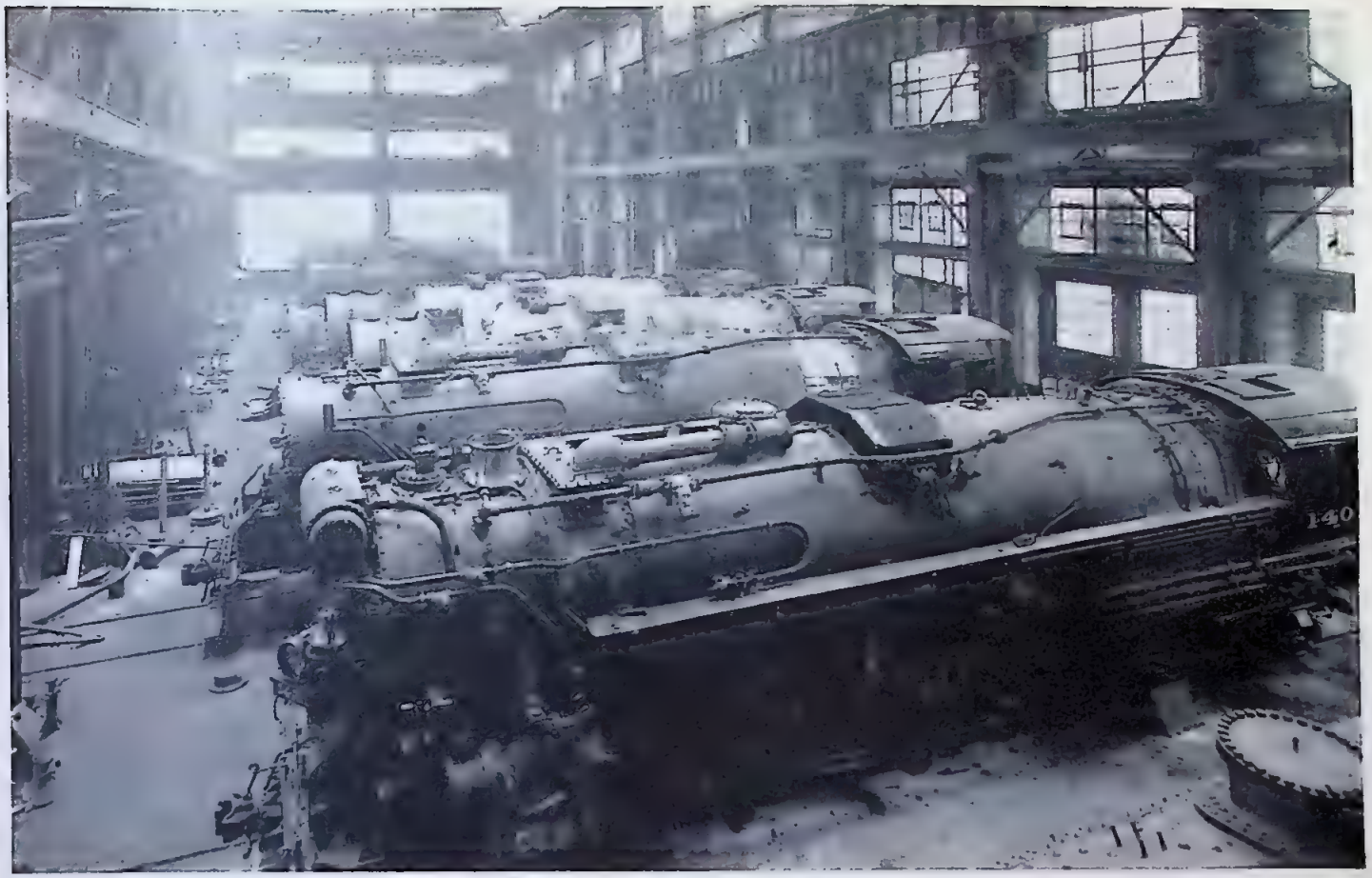
THEN the news broke: the stockholders of Lima Locomotive and General Machinery of Hamilton, O., were considering a merger of their properties. The Hamilton firm's interest in such a combination was obvious. It produced diesel engines, and in 1947 the railroads were a bonanza market for diesel engines — mounted in locomotives. The company also had a free-piston gas turbine under wraps that looked like a natural for locomotive use. Corporation lawyers ironed out the details and the Lima-Hamilton Corporation was formed. Two years later, in 1949, Lima-Hamilton completed its first diesel and its last steam locomotive. The diesel was a 1000-horsepower yard engine for the Nickel Plate; the final steam power to carry a diamond data plate was also NKP: S-3 2-8-4 No. 779.

The Lima-Hamilton line of diesels was subject to normal development pains, but the locomotives were good enough to send back one repeat order after another to the home plant. Built into each one of them was a measure of Lima's traditionally fine craftsmanship. Upstairs in the drafting rooms the old staff worked overtime to acquaint itself with the innards of the newcomer it had fought so diligently. Plans for locomotives with double-Belpaire boilers were filed away while the diesel line was expanded to include a 1200-horsepower road-switcher and a 2500-horsepower transfer unit. And a wash drawing of the new gas turbine was prepared. The diesels — 172 of them — were foreign to the world of the late Will Woodard, but at least Lima was building locomotives.

ONE noon a Lima man dropped into his broker's office during the lunch hour. The tape inching out of the ticker told the unbelievable story: Lima-Hamilton was merging with the Baldwin Locomotive Works. Henceforth both would be the Baldwin-Lima-Hamilton Corporation ("hardly an inspired title," as the *Investor's Reader* commented). He rushed back to the plant that summer day of 1950 to break the news. Nothing much seemed to get accomplished that afternoon. As TRAINS saw it, the marriage was "hardly a happy wedding." Both companies had switched horses in midstream after the war and neither had made a genuine success of steam or diesel. There was, moreover, widespread duplication of product in the BLW and L-H locomotive lines.

The result was inevitable, and it took place on September 11, 1951. Pennsylvania Railroad No. 5683, a 2500-horsepower transfer engine, was pulled out of the erecting hall into the sun. It was Lima's last locomotive, the final decimal point after over 7700 locomotives. Quite a force from the office and shops was on hand to look it over. In other, happier years there had been confident talk and proud smiles when a new engine left the "Loco." But there was no talk and there were no smiles when the Works' tiny Plymouth diesel took Pennsylvania No. 5683 out through the plant

Lima's last locomotive — Pennsylvania Railroad 2500-horsepower transfer diesel No. 5683 — was taken outside the plant by the works' Plymouth yard engine on Wednesday, September 12, 1951. Sign across side of building indicates the corporation scramble that eased the works toward this day.



Six Boston & Albany 2-8-4's on the Lima production line in 1926. After the test of the A-1 over the B&A, the road purchased 55 such machines. And B&A gave the new wheel arrangement its name of Berkshire. Except for two (Nos. 1423 and 1434) sold to the Tennessee, Alabama & Georgia, all of these pioneer engines have been scrapped following dieselization of their roads. Their drag tonnage design made continued service on other districts of the New York Central uneconomical, since the rest of the system is geared to a faster, water-level movement of its freight traffic.

gates. Twenty years before locomotive production had ceased, too, but then the cause was hard times and sooner or later everyone knew the Works would reopen. But hard times had nothing to do with what took place this day.

It seems incredible that the crane and shovel trade, organized as a sideline in 1928, is now the full-time occupation of Lima. The machines that made it famous are too close at hand in 1952. The office building looks down on a Nickel Plate engine terminal where Lima-built Berkshires are being coaled and greased for the road. And the windows of the entire plant vibrate when a pair of the Baltimore & Ohio's Lima-built 2-10-2's go rampaging south to Cincinnati with a hundred hoppers behind their Vanderbilt tanks.

Today in Lima, O., the cab driver reports in to the fleet dispatcher:

"Going out to the 'Loco.'"

Only somehow it isn't the "Loco" any more.

BECAUSE I was brought up in a railroad neighborhood and had to wash the Milwaukee Road's soft-coal smoke out of my hair every Saturday night, I can remember many an apocryphal railroad yarn which can't be put in print because some reader might step up and prove it wasn't true. But one of my fondest memories is the remarkable story of the stolen locomotive, which sticks in my mind so strongly from 30 or more years ago that it must be true.

The story starts with a Chicago & North Western Mike, sitting on the ready track at Butler (Milwaukee) roundhouse, with steam up. A trespasser, who must have been an ex-railroad man to know the rules so well, climbed up the gangway, hung white flags in the sockets, lit the white classification signals, and pulled out of the yard, bound west on the main line. He kept carefully in the clear of scheduled trains, and either had enough luck not to meet any opposing extras, or had studied the train sheet and knew there were no extras in his way.

At any rate, operators along the way dutifully OS'd the light engine running extra, "North Lake, Extra 2307 West at 8:15," and so on. Incredible as it seems now, the lone rider had run his 200-ton steed nearly across the state of Wisconsin, some 150 miles, before some dispatcher checked back in the orders issued the preceding trick and found that no "Extra 2307 West" had been ordered out on the road.

So at the next station the extracurricular engineman was faced with a red order board, and knowing the ropes as he did, he stopped — to be met by a sheriff at the bottom of the gangway. He gave up, was brought back to Milwaukee and arraigned on a charge of grand larceny, certainly a fitting denouement for such an escapade.

But when the case came up in court, the judge threw it out. "No larceny," said his honor. "The locomotive was never removed from North Western property." — *A. C. Kalmbach.*

The Lima story: 2

BLUEPRINT

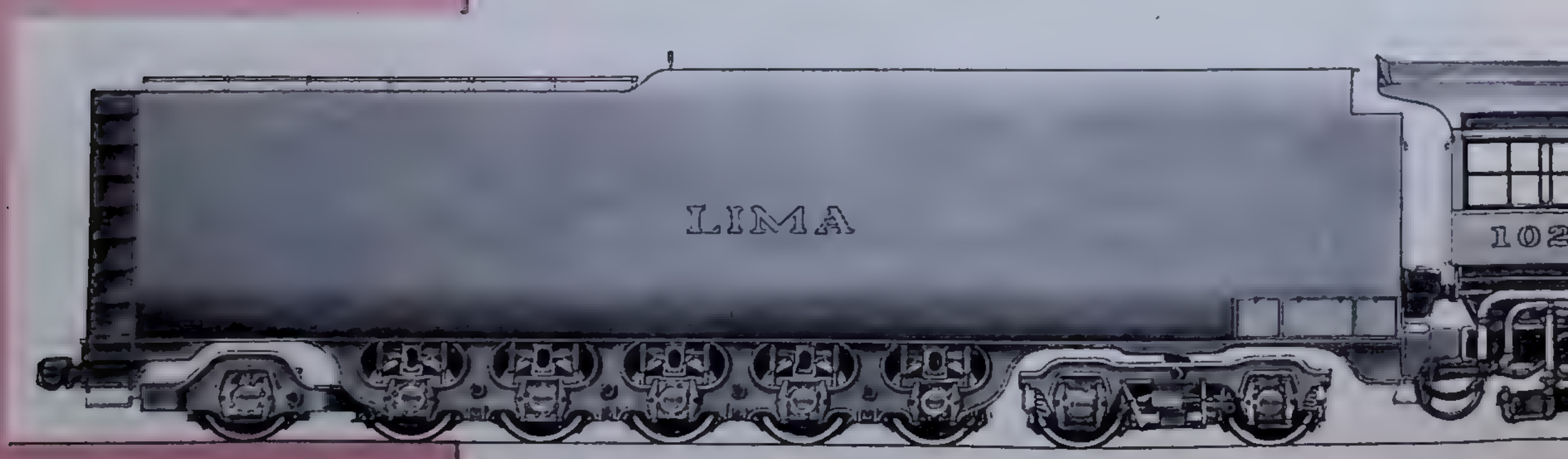
Here is the story of the steam locomotives that Lima never built — including the 4-8-6 it designed to lick the diesel

BY DAVID P. MORGAN

BY 1946 General Motors' fair-haired diesel locomotive offspring, Electro-Motive, had the world on a string and the motive power market in its pocket. It was mass-producing a locomotive that could stomach 30,000 high-speed miles a month or outperform the biggest steam power in existence, and it was immune to the plague of coal-miner walkouts. Sworn steam strongholds were conceding defeat month by month, anxious for diesel savings to close up the gap between inflated costs and static rates. For EMD there stretched a minimum of 10 years of peak production before the market was saturated, and when that day came, a lucrative parts business would be its mainstay. The steam locomotive was all done, straight electrification cost too much, and the gas turbine existed only in theory. Electro-Motive had never had it so good.

In September of 1946 a delegate from the Lima Locomotive Works took the rostrum at the Hotel Sherman in Chicago to reassure the worried Master Boiler Makers' Association: "Whenever you hear that the steam locomotive is all done, washed up, and ready to be put away, just remember the old story of the hammer and the anvil — it was the hammer that wore out."

What manner of man was this who dared make such a prophecy at a time when the engineering profession was squeezing the reciprocating steam locomotive into a casket? The question warrants answer, for by 1946 it was apparent to many that a ceiling had



LOCOMOTIVES

been reached on the development of steam power. It was impractical to construct firetube boilers with more than 300 pounds pressure; steam engines lacked constant torque at low speeds; and existing axle load limits prohibited the building of bigger locomotives to overcome these disadvantages. In a few instances modern steam power might keep pace with a diesel, but such a condition would be temporary because while the diesel was developing, steam was static.

Albert J. Townsend, Lima's vice-president of engineering and its spokesman before the boilermakers, was keenly aware of the steam locomotive's limitations. As a member of the Works' staff since 1917, he could also recall another era when there seemed to be a ceiling on steam. During the First World War there were several engines capable of over 150,000 pounds of tractive effort in the tonnage department, while the problem of heavier, all-steel passenger trains was also being overcome by simply adding more drivers. Actually, the builders were reaching a limit on tractive effort and sheer size in those days, but, and as Lima's A-1 Super-Power engine proved, they were only beginning to tap the potential efficiency of steam.

The dual-service 4-8-4, the simple articulated and the thorough modernization of the Mallet all came after the "ceiling" of the First World War.

Over the years the men of Lima retained their characteristic dislike of locomotive inefficiency. A good percentage of Lima locomotives were built to supplant comparatively new engines simply on the strength of their greater economy. As W. E. Woodard (creator of the A-1) remarked in 1928, "Advances are always initiated as a result of comparisons." Woodard was not always as successful in obtaining the practical application of his ideas as he was with his 2-8-4, but at least he inked them into working blueprints.

ONCE his big Berkshire had thoroughly proved the ability of Super-Power to cut the railroads' coal costs, Will Woodard took up the problem of locomotive maintenance charges — which in the same 1920's were taking a far bigger bite out of the carriers' budget than were their fuel bills. Of each dollar spent to maintain a locomotive, Woodard estimated that a third went into the boiler while two thirds was applied to the "steam-using plant" — the cylinders, rods and drivers. He thought that the cure for boiler ailments lay in a watertube unit that eliminated troublesome staybolts; and since the Baltimore & Ohio was already hard at work on that theory, he went beyond to the locomotive's running gear.

The increased piston thrust of modern power tended to strain an engine's rods and frame as well as to place terrific pressure upon its journals. "Anyone who rides locomotives of great power has felt the working of these enormous forces upon the locomotive structure," Woodard said. And the greater the width between the two cylinders, the greater were these forces, he thought. So he designed locomotives that incorporated both the tandem main-rod drive (which his new 2-8-4 had successfully demonstrated) and "unitary machinery support" — which was a single casting of the cylinder saddle with supports for valve gear and crosshead guides. By these methods Woodard lopped off 5 to 7 inches of crosswise width from one cylinder to the other. Front-end strength was improved with a consequent reduction in projected maintenance costs.

The Mallet or simple articulated was the greatest offender in the matter of running gear maintenance, of course, because it was actually two separate engines taking steam from one boiler. Yet for years it had been the only method the railroads had had of obtaining great power with working flexibility. As a possible replacement for a simple 2-8-8-2 with 63-inch drivers and a tractive effort of 130,000 pounds, Woodard proposed a 2-12-6 in 1928.

On paper, at least, this Lima locomotive not only eliminated four drivers and a pair of cylinders but it also shaped up as a better steamer because its six-wheel rear trailer supported a firebox with 151 square feet

This impression of Lima's super 4-8-6 is based upon actual known specifications that the builder prepared in 1949 and is further refined with such aids to efficiency as roller bearing axles and rods, overfire jets, solid pilot and pilot beam casting, booster, and a 4-10-2 pedestal-type tank of General Steel Castings design. The engine has 70-inch drivers for dual service.

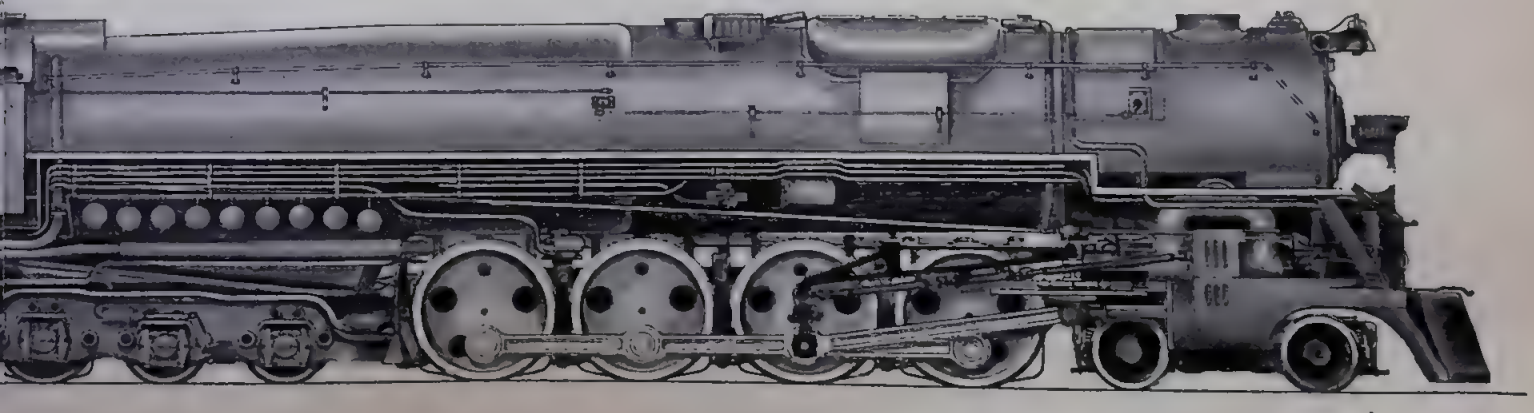


Photo of an engine that was never built: An artist's airbrush "rebuilt" a stock view of a Chesapeake & Ohio J-3 4-8-4 into a double-Belpaire-boilered engine equipped with Franklin long-compression, rotary cam type poppet valves. This print is the only known photographic likeness of the super design that Lima engineers conceived as a reciprocating answer to diesels.

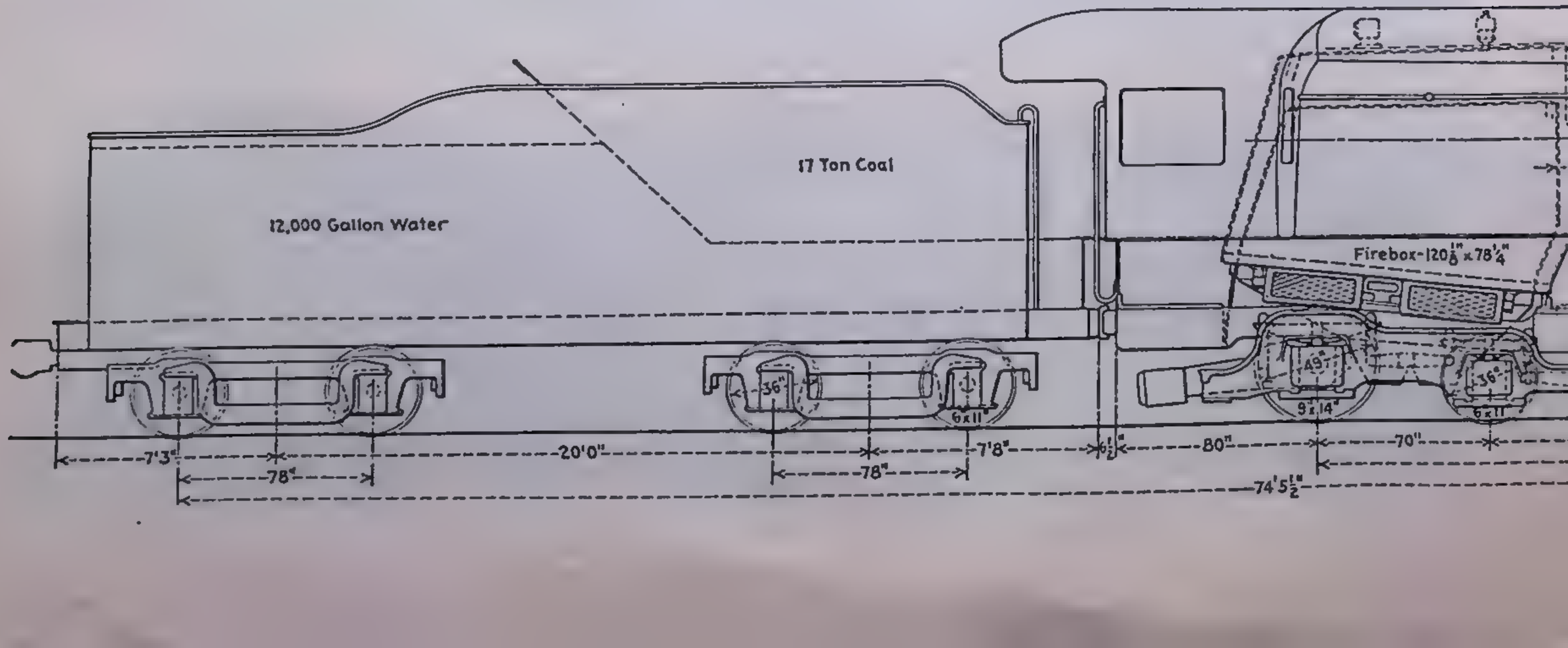
of grate area as compared with 110 square feet for the 2-8-8-2. Woodard's engine carried a pair of huge 32 x 32-inch cylinders out on the front end of her frame, ahead of the smokebox. These were equipped with a modified form of his unitary machinery support and they drove on the second pair of drivers. Woodard explained confidently that, weird an elephant as his 2-12-6 looked, "There is nothing in the elements of this design which have not a sound basis in development already done or by comparison with existing practice."

The 2-12-6 was never built. But Lima-built 2-10-4's did roll forth to replace articulated engines on both the Chesapeake & Ohio and the Kansas City Southern. And in 1939 a six-wheel trailer truck was utilized on the Pennsylvania's S-1 6-4-4-6; in later years it was also specified for PRR's S-2 6-8-6 turbine as well as for the 2-6-6-6 articulateds that Lima built for the Chesapeake & Ohio and the Virginian. Regardless of whether his ideas were used or not, Woodard was no visionary; no design of his was ever published with questionable engineering in it. Lima locomotives were sold as workhorses, never as experiments.

Yet Woodard appeared to be a radical engineer because he seldom worked within contemporary limitations but ahead of them. When articulated, lightweight diesel-powered streamliners showed up in 1933, for instance, Lima's chief engineer quickly recognized their competitive virtues for the railroads. He also saw that lightweight standard equipment was in the offing, and that Lima should have a suitable locomotive among its blueprints when the industry came knocking.

In September 1934 (the same year in which the *Pioneer Zephyr* entered scheduled service), he took the wraps off Lima's entrant in an article for *Railway Age*. His engine was a semi-streamlined 4-4-4 equipped with 7-foot drivers, poppet valves and a booster. Woodard guaranteed a sustained 2200 horsepower at all speeds above 30 miles an hour, with a conservative top speed of 100. This was more than enough power to keep a six-car, 250-ton train rolling at a consistent 90 miles an hour over tangent level track.

The 4-4-4's booster increased her starting tractive effort to 43,100 pounds in spite of the 84-inch drivers, and once she was under way the big wheels held machinery speeds down



to reasonable levels. Moreover, the cylinders drove on the first pair of drivers — a principle which Woodard pointed out "was one of the great virtues of the old eight-wheeler" as a contribution to smoother operation. The poppet valves separated the timing of admission and exhaust of steam within the cylinders, which would have increased her horsepower at 100 miles an hour by as much as 50 per cent over conventional Baker or Walschaerts gear.

The design of the smallest details revealed painstaking care: the boiler was to be constructed from nickel steel, tender trucks were of welded design, and the booster was a comparatively high-speed unit — cutting out at 20 miles an hour.

Only a handful of lightweight steam passenger locomotives were built, and the Lima 4-4-4 was not one of them. In May 1934 the Baltimore & Ohio had announced that it was converting an Atlantic into a high-speed 4-4-4; the Lima 4-4-4 was unwrapped in the press during September of the same year; and at approximately the same time the B&O's J-1 *Lady Baltimore* was turned out by Mount Clare Shops, Baltimore. At first glance it looked as if somebody had been looking over the fence, for the *Lady* strongly resembled the Lima design. The similarity did not end there: both designs had boosters, 84-inch drivers, similar grate areas — and both were designed for 250-ton trains. But the B&O No. 1 had considerably smaller cylinders driving on her rear pair of drivers, a change that may have accounted for her rough starting traits. She was also much lighter and developed 1570 horsepower instead of 2200 at 95 miles an hour.

Actually, the locomotive that bore the greatest likeness to the Lima 4-4-4 was the *Hiawatha* Atlantic type that American Locomotive designed and built for the Milwaukee Road in the spring of 1935. Both engines had comparable (in some instances, identical) wheel base, tractive effort, weight, maximum cutoff and grate area. Judging, therefore, from the outstanding success that the Alco engine enjoyed out on the road, it would appear that the Woodard design was fundamentally sound. Indeed, the Lima 4-4-4 would have stood a healthy chance of outperforming the Milwaukee 4-4-2 because of its poppet valves and booster.

But except for 15 light 4-4-4's built for the Canadian Pacific, the proposition was dead within a few years. Streamliners quickly outgrew the capacity of the specially designed high-speed steam locomotives, and the roads turned to larger Hudsons. And by that time Lima was constructing its first streamlined locomotives, Southern Pacific GS-2 4-8-4's.

PERHAPS these designs and others were in the mind of Bert Townsend as he stood before the Master Boiler Makers' Association in 1946. His chief, Will Woodard, had died in 1942, but the old man's unshakable faith in the reciprocating steam locomotive was still very much alive. Over the years the Works had accumulated an impressive knowledge of such power — how it might be designed and how it should be built.

". . . Go to any station or terminal almost anywhere," continued Bert Townsend, "and once again take the advice of the grade crossing sign, STOP, LOOK AND LISTEN. You will see many a steam locomotive going out with its train and you will hear the story of the exhaust barking up into the sky — 'I take you there; I bring you back.' And of course, if the drivers slip, the old girl will tell you she has been doing that for over 100 years; and then as she settles down to pulling again will repeat the century-old story, 'I take you there; I bring you back.' And that, gentlemen, is the first principle of transportation. All the others follow after."

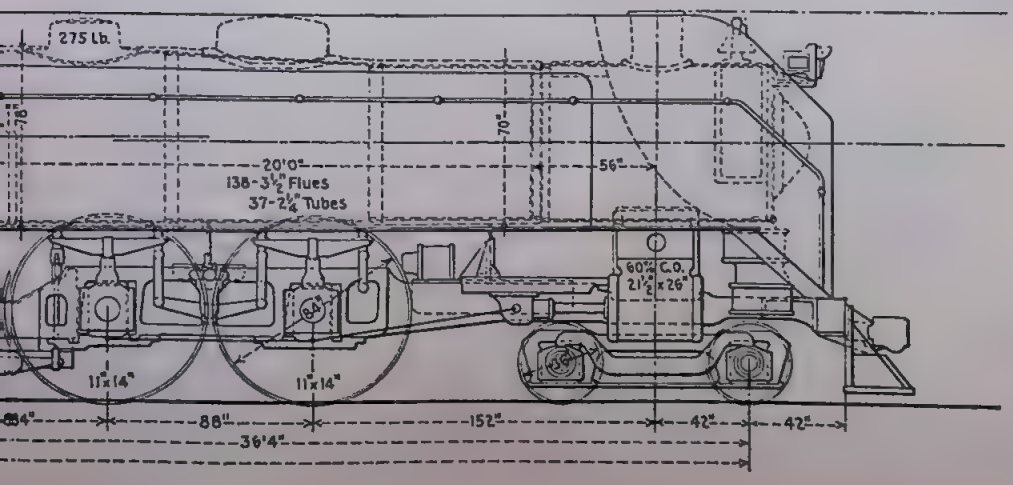
Was Lima frightened by the specter of Electro-Motive? Not by the packing in your cylinders it wasn't!

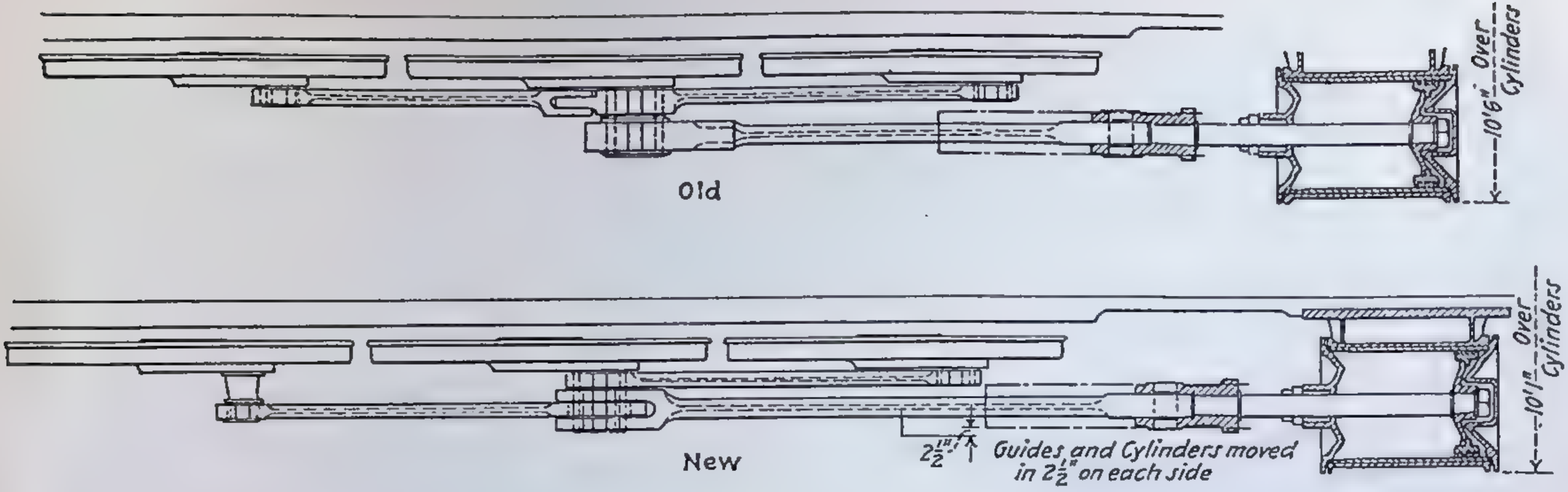
The engineering department of Lima began its search for a better steam locomotive by first appraising the diesel and its appeal to the railroads. First, and as Townsend freely admitted, "Everyone is talking about how much fuel they save with the diesel. They are right; they are saving it." Somehow the appetite of a high-horsepower boiler had to be cut back. Next to overcome was the diesel's operating advantage of constant torque — that is, the smooth application of tractive effort, especially at low speeds. A diesel could not only out-pull a steam locomotive of identical horsepower, but it also did a better job on a sustained grade where the big steam power was apt to lose its feet at low speeds. Lima's search was two-fold, therefore: put the steam locomotive on a diet and give it a smoother torque.

Elementary thinking guided the effort to design an improved boiler. It was known that the harder any boiler was worked, the greater was the amount of coal needed to keep it hot. The engineers accordingly set to work creating a boiler capable of such a huge steam output that it need not be worked at its maximum. To this end the conventional radial-stayed or roundtop boiler was thrown out in favor of the Belpaire type, most extensively used in this country by the Pennsylvania and the Great Northern and identified on the outside by its flat-topped firebox and combustion chamber. Lima men modified the Belpaire by using its flat surface at the bottom as well as at the top, thereby evolving a design that was quickly dubbed the double Belpaire. As compared with the radial-stayed type, the double Belpaire provided more of almost any index of a good boiler in the same space — more tubes, gas area, evaporating area, steam space and water space. For example, the double Belpaire jumped the total evaporating area by 10 per cent, which meant that the new boiler could boil its water 10 per cent faster — with a similar increase in steam supply. An increase in gas area of 10 per cent meant a better steaming unit of more capacity. Townsend added it up like this: "We want to get heating surface, superheating surface, grate area and, above all, gas area, because the stuff burned in that firebox has got to get out."

The Lima people thought that such

Lima vice-president Will Woodard blueprinted this streamlined 4-4-4 in 1934 as an acceptance of the challenge offered by early diesel articulated trains. Seven-foot drivers promised 2200 horsepower at 90 miles an hour. Milwaukee Road Atlantic of 1935 was remarkably similar.





Woodard's tandem-drive rods and unitary machinery support sliced inches off the width of a locomotive across its cylinders, therefore promised substantial savings in maintenance due to reduced stresses in the frame and rods and less pressure upon the driving axle journal boxes.

a boiler could be manufactured without adding any extra weight to the locomotive. Another advantage was actually given a miniature test on a one-sixth size model of the double Belpaire that Lima built. This was deflection. Under full pressure the average boiler tended to expand at the sides and drop at the top; often a deflection of one half to three quarters of an inch took place. The model, tested to 300 pounds pressure by hydrostatic means, did not bend significantly.

But a boiler — even a good one — was only half the job. Some idea of what could be accomplished by modernizing the "steam-using plant" was gained by listening to the grapevine reports that drifted in about New York Central 4-8-4 No. 5500, Burlington 4-8-4 No. 5635, Missouri Pacific 4-6-2 No. 6001 — and all the other engines with some form of poppet valves, either the oscillating or the rotary cam type. Poppet valves had been suggested by Will Woodard as early as 1934 for reconsideration in the U. S., and by 1937 the Franklin Railway Supply Company (of which he was an associate) had a working model set up. In 1939 the Lima Locomotive Works itself rebuilt a Pennsylvania K-4 Pacific, No. 5399, with such a steam distribution system.

The essence of poppet valves was this: they divorced the entrance and exit movements of steam in and out of the cylinder. With reciprocating valve motion, one valve controlled both these cylinder "events," whereas each deserved separate timing according to the speed or power required of the locomotive. Poppet valves permitted a long-compression locomotive; that is, the squeezing of all possible energy out of the steam. And because the lighter and more precise poppet valves worked far faster, a smoother torque was possible together with less waste of steam (and coal). This innovation also served to eliminate some heavy side-rod motion, with a consequent reduction in track pound, and reduced the power reverse requirements from over 50 horsepower to about 5.

This simplified review of Lima's accomplishments fails to reveal either design details or projected performance simply because from the first the entire project was pretty hush-hush. This much is known, however. Before and throughout the development of their super engine, the Lima engineers made an examination of the best U. S. steam locomotives — possibly the most extensive research on the subject since Will Woodard designed the first 2-8-4 in 1925. Under Townsend's guidance, the staff once again reviewed the Altoona test plant bulletins, took a special trip to inspect the poppet valves of Delaware & Hudson Pacific type No. 653, and dug into the performance sheets of practically every outstanding design from 4-8-4's to articulateds — always looking for just the perfect ratio, just the correct balance. After theoretical designs were drawn up which combined double Belpaire boilers with rotary cam poppet valve gears, there was a surge of fresh hope and confidence.

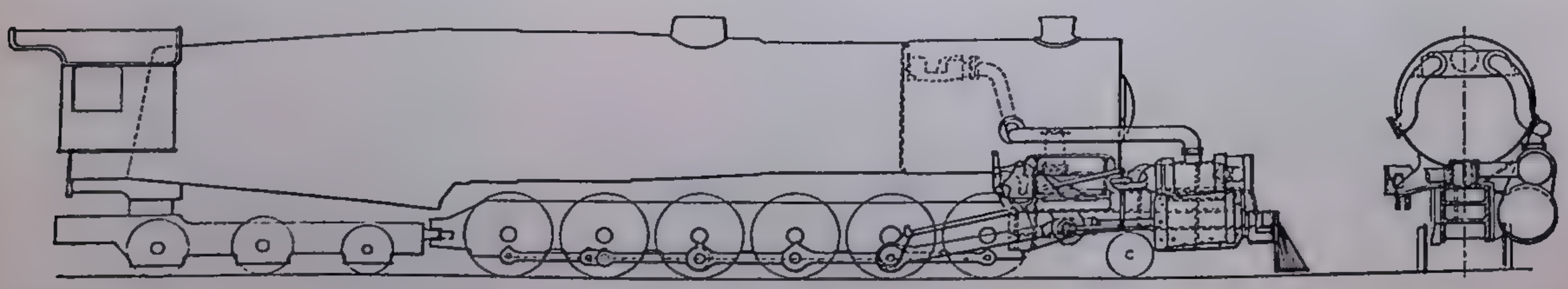
One Lima man puts it this way. "We were trying to make a steam locomotive into something else . . . [into] a *real*, not only a theoretical, competitor of the diesel."

Among other plans, Lima prepared a blueprint for a double Belpaire application to an existing New York Central J-3 class Hudson, and the Central came very, very close to ordering such an installation.

Why didn't other roads show equal or greater interest? Why didn't Lima build a demonstrator if its proposed design really could pace the diesel?

The answers to these obvious questions vary. It is said, for instance, that the railroads objected to a Belpaire boiler because it required special maintenance techniques — "It's all right for Altoona — but we never had one on the property and wouldn't know how to repair it." Others thought that maintenance costs might be higher than for radial-stay units. There is also the opinion that the super engine was late to the party, that the diesel had already got a corner on the punch bowl and the first dance

Esthetic considerations were thrown aside in the blueprint for Lima's 2-12-6 of 1929, an engine designed to replace articulated 2-8-8-2 freighters — with a corresponding reduction in maintenance charges. This Woodard design incorporates first known six-wheel trailer truck.



When the Lima Locomotive Works held a postwar open-house day for railfans, display power included (from front to rear of shop): PRR K-4 No. 3847 equipped with rotary cam poppet valves; PRR J-1 class 2-10-4; NKP 2-8-4; and Erie 2-8-4. Scale model of proposed Lima double-Belpaire boiler is at foot of Pacific's cab stairway. A one-sixth size working model was also built.

with the railroads. The carriers were either completely satisfied with the proved economies of the diesel or they might have had difficulty explaining why they switched back to the iron horse in midstream.

It is quite possible that the Works would have built a demonstrator if the merger with General Machinery had not come about in 1947. Once the builder became Lima-Hamilton its absolute faith in steam was broken; diesels replaced steam locomotives in the Works' order books and, apparently, in its affection.

WHAT would have happened if the new super steam locomotives had been built? The question is academic in 1952, of course, but it has intriguing possibilities.

For instance, the pride of the plant was a 4-8-6 type, essentially an overgrown Northern capable of accepting either passenger or freight assignments. Its six-wheel trailer truck supported a firebox with a grate area of nearly 133 square feet — approximately that of a Chesapeake & Ohio 2-6-6-6 — and its total engine weight figured out to 525,000 pounds, slightly more than for a Santa Fe 2900-class 4-8-4. Such an engine would have dug in with a tractive effort of 87,000 pounds including the assistance of a high-speed booster good for operation up to 35 miles an hour.

The 4-8-6's availability (percentage of time it was available for work) could have been kept equal with that of a diesel's provided the steam locomotive had equivalent servicing and terminal repair facilities. This would have meant standby pairs of drivers, drop pits, extra roller bearing assemblies, one-location sand, water and coal sites, and "lubritoriums." Too often, modern 4-8-4's were handicapped because there had been no corresponding modernization of obsolete engine terminal facilities at the time of their purchase. The fact that it can be done has been demonstrated on the Norfolk & Western, principally at its Shaffers Crossing layout at Roanoke.

A clue to the super engine's maintenance is gained by the fact that in a series of controlled tests sponsored by the New York Central, an S-1 4-8-4 reflected an annual repair cost-per-mile figure of 35 cents — or approximately that of a 4000-horsepower, two-unit diesel. Any extra cost of maintaining the double Belpaire boiler would have been saved by its welded construction and lack of significant deflection under pressure.

As an engine, the 4-8-6 was not inferior to a diesel in the realm of high monthly or annual mileages, and if one had been accorded the proper tender and fuel, water and ash facilities en route, it is felt that she could have easily made, say, 25,000 miles a month — year in and year out. If Lima's thinking was correct (and it usually was), those would have been the best miles any steam locomotive ever recorded: smooth torque miles, low coal consumption miles, high-speed miles, abundant horsepower miles.

Lima's forges and lathes were never put to work fabricating a double-Belpaire, poppet-valve 4-8-6, and since it was designed the reciprocating steam locomotive has been permanently shelved. Steam may return in the guise of a turbine-electric, complete with a watertube boiler and traction motors. But steam in its familiar dress of a tapered boiler, slab rods and disc drivers is "all done, washed up, and ready to be put away." Its most promising bid for longevity was never built.

Inspection locomotives

INSPECTION locomotives in the Nineties appeared to be the fantastic ultimate in Mother Hubbard or Camelback motive power — perhaps the dream of a draftsman whose sympathy for the engine crew's comfort got the best of his blueprint. In reality, of course, the inspection locomotive was just what the name implied: a self-propelled observation unit for the use of railroad officials checking over the right of way. Although they are often considered part and parcel of a gingerbread age in railroading, inspection locomotives were, in their time, an inexpensive way of looking over the railroad. In the 1890's there was no gasoline speeder on the market, much less a diesel railcar. And, comparatively speaking, both wages and fuel were dirt cheap.

The inspection locomotive no doubt developed from the post-Civil War passion to ride the pilot, where the view was unobstructed. It is a recorded fact that two members of the California Railroad Commission inspected the Central Pacific from Sacramento to the eastern state line in this manner back in 1869. Then the breeze and buffalo blankets inherent in such line checks gave way to makeshift enclosures erected ahead of the smokebox. That, in turn, brought on the genuine inspection locomotive — designed as such from the drivers up or rebuilt from an existing locomotive. Saddled over the boiler from stack back was a semi-coach body; its forward compartment was reserved for the officials and usually featured plush chairs and a good grade of green carpeting. Behind the wooden partition was the engine crew. The standard locomotive tender coupled on behind permitted the light load ample time on the road between fuel and water stops.

The chassis for the earliest inspection locomotives was often a single-driver but later models were mounted on Moguls, 4-4-2's and Americans (4-4-0). The latter achieved the greatest popularity for the purpose, a fitting salute to the wheel arrangement in view of its useful life in all other railroad assignments.

The greater economy of the internal combustion engine for such purposes killed the inspection locomotive. Even automobiles with flanged wheels now serve traveling officials. Today the inspection locomotive is just a memory of an odd but often beautiful engine that belongs to another and *passé* hour of the railroad scene.

This elegant Boston & Albany carriage was originally a standard Rhode Island 4-4-0 built in 1869. She was rebuilt as the Berkshire and served the road until 1928. Note steps to lounge.

The Lehigh Valley's famous No. 1, otherwise known as the Dorothy, was typical of the early single-drivers. She was built by Wilkes-Barre Shops in 1884, is said to be retired in Bear Creek, Pa.

The St. Lawrence & Adirondack's old St. Lawrence wa— She proved too small for the NYC subsidiary's use,

Except where indicated, all photos from Rail Photo Service.

The Chicago, Burlington & Quincy's No. 475 was a half-breed among inspection locomotives. A conventional American Standard was equipped with a large observation gallery over her smokebox and pilot, the engine crew holding down a conventional cab at the rear. Note sun visor here.

custom-built 2-4-6, delivered by Schenectady in 1892. came a Central Vermont 4-4-0, and was cut up in 1928.

Museum of Transport.

Latest addition to St. Louis' flourishing Museum of Transport is the Black Diamond, built in 1898 by Baldwin as a president's private car for the Reading. Top speed was said to be 60.

CORNWALL RAILROAD, 1895

The Cornwall Railroad of 1950 offers only freight service, but back in 1895 it ran five daily passenger trains in each direction between Lebanon and Mount Hope, Pa., the two terminals on its 12-mile line. Three of these round trips extended another 19 miles to Columbia on the rails of the Reading & Columbia, now part of the Reading Company. The American Standard locomotive Penryn is standing at the Lebanon station with a single coach and combine, ready to make the noonday run to Columbia. The Cornwall carried 71,347 passengers 428,082 passenger-miles in 1895 and thereby earned $11,698. Bethlehem Steel bought the line in the 1920's and discontinued passenger service shortly afterward.

L. G. Harpel.

PRR ventures in locomotives

Exceptions to the Pennsylvania's rule of motive power standardization

GENERAL W. W. Atterbury sold his Pennsylvania Railroad on the idea of locomotive standardization more than a quarter of a century before Electro-Motive lifted the industry's eyebrows with its mass production diesels. As General Superintendent of Motive Power for the PRR in the new years of the century, he foresaw that the policy of building many engines to a few proven patterns would not only slash construction costs but eventually save incalculable millions in routine repairs. Then too, there was the added advantage of interchangeability of boilers and running gear, tenders and cabs. It was observed in 1914, for example, that the Belpaire boiler of the heralded K-4 Pacific could generate steam just as well for the drag freight L-1 2-8-2, which is why Juniata boilermakers engineered both classes from one blueprint.

This selection of Pennsylvania locomotives proves, however, that the best laid plans of men and motive power often leave the track. War traffic arising from two international conflicts forced engines on the PRR that had nothing in common with keystone number plates and horizontal pilot grills: Pennsy accepted U.S.R.A. power under protest in one instance, went shopping on its own for a "foreign" design in another. The evolution in electrification that culminated in the GG-1 naturally produced several unfortunate square pegs. And while the road built or bought both compound and simple articulateds, it never went overboard for jointed locomotives.

These, then, are the strays and the black sheep in the Pennsylvania's vast flock of locomotives, the engines that failed to fit the system's standards.

Pennsy's first duplex-drive freighter never warranted duplication; now the Q-1 opposed-cylinder 4-6-4-4 No. 6130 is unstreamlined.

Glenn Grabill Jr., Rail Photo Service.

MOTHER HUBBARD

The PRR's first Atlantics, E-1 class engines 698, 700 and 820, were also the first and only Mother Hubbards on the system. Juniata built the set in 1899 for the hot Camden-Atlantic City, N. J., competition with the Philadelphia & Reading, which used Vauclain compounds. The simple E-1's featured a combination Belpaire-Wooten firebox and an English-style six-wheel tank. After some fast running they were turned over to the Long Island and scrapped by it in 1911.

George B. Ritz.

FRENCH COMPOUND

In 1904, the Pennsylvania came down with the prevalent compound fever and ordered a de Glehn System Atlantic from the Societe Alsacienne de Constructions Mecaniques, Belfort, France. Similar to Paris & Orleans 4-4-2's, No. 2512 was assembled in Altoona and fitted with a pilot and tender water scoop. Displayed on the Louisiana Purchase Exposition test plant in St. Louis, the experiment also ran road trials. Ultimately she proved too light, was scrapped in 1912.

BALDWIN COMPOUND

Two class E-28 Baldwin compounds were installed in service in 1905. In this design the two inside high-pressure cylinders drove the first driving axle; the outside low-pressure cylinders drove the rear driving axle. All cylinders were placed in line beneath the smokebox. No. 7451 boasted of a 23,500-pound tractive effort. No. 7451 was assigned to the Pittsburgh, Fort Wayne & Chicago, while her sister was placed in service between the Smoky City, Washington and New York.

TRAINS collection.

TRAINS collection.

COLE COMPOUND

One of two Cole compounds built by Alco in 1905, No. 7452 went to Lines West. But the efforts of de Glehn, Baldwin and Cole failed to win PRR over to compounds.

LARGEST PACIFICS

The construction of two K-5 class Pacifics for the Pennsylvania in 1929 was a case of reaching beyond perfection. For 15 years the classic K-4 had met every heavy, high-speed passenger demand of the system; from 1914 to 1927 the PRR had built and bought over 400 such locomotives. Then, on the eve of electrification, the road designed an even larger Pacific at a time when other carriers were following the New York Central's significant shift to the Hudson type. No. 5698, illustrated in these two views, was built by Juniata, while sister 5699 was outshopped by Baldwin and equipped with Caprotti valve gear. The major external differences from the K-4 design were incorporated in the K-5's great cylinder saddle, enormous smokebox diameter, location of bell beneath headlight, and Worthington feedwater heater placed behind a big stack. The K-5 was only slightly heavier than the K-4, churned up its impressive tractive effort (54,675 pounds) by having a greater heating surface plus a higher boiler pressure of 250 pounds. When new, No. 5698 is reputed to have hit 125 miles an hour with small difficulty, but she was no match for contemporary 4-6-4's on a horsepower basis. Still in service, the two K-5's have never been duplicated or rebuilt by the PRR.

Frank Clodfelter.

U.S.R.A. SHIFTER

The United States Railroad Administration, which took over the railroads in World War I, was an intolerable grind for the PRR. An NYC man was placed in charge of the Eastern region, the *Broadway Limited* was cancelled, B&O was allowed to use the Hudson River Tunnels, and Pennsy was forced to accept U.S.R.A. locomotives in place of its own designs. No. 7641, posed in Canton, O., last year, is typical of the B-28 class, as PRR designates its government 0-6-0's.

Paul Ellenberger.

"THE BIG ENGINE"

The mighty S-1 class 6-4-4-6 No. 6100 represented the combined engineering knowhow of the PRR, Alco, Baldwin and Lima. Constructed in Juniata in 1939, it was immediately sent to the New York World's Fair, where it was known as "The Big Engine." On the road the duplex-drive fell short of her advance publicity; sheer size was her notable downfall. She is remembered, however, for her fabulous speed and smooth riding qualities — not enough to postpone scrap.

Paul Ellenberger.

U.S.R.A. MIKADO

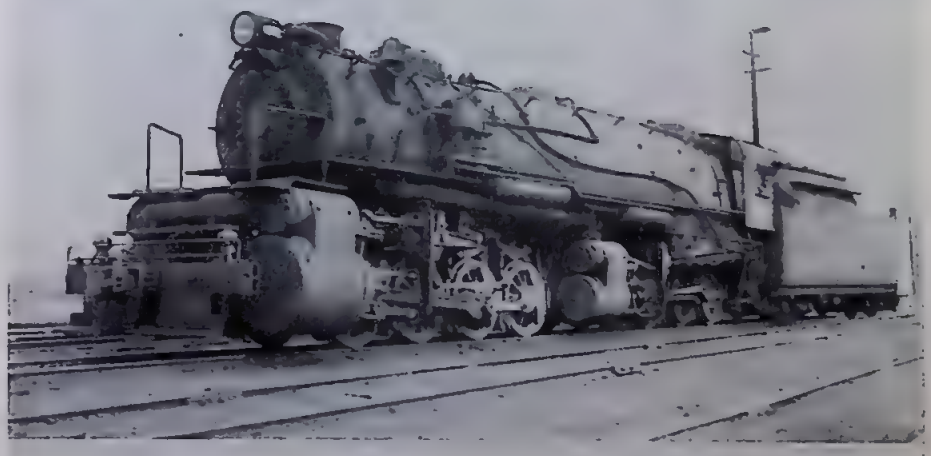
Among U.S.R.A. locomotive designs, the light Mikado is still regarded very highly. Able to hold its own on a weight basis in tonnage service, this Mike also had the ability to roll fast. In addition, its axle loading permitted it to work many light lines closed to other power. Lima Locomotive built 10 for the Pennsylvania. While it rebuilt 30 light U.S.R.A. 2-10-2's with Belpaire fireboxes, the PRR never bothered to alter the L-2 design. All have been retired and are now scrapped.

Paul Ellenberger.

COMPOUND ARTICULATED

Like the New York Central, but unlike the Baltimore & Ohio, PRR never thought too highly of articulated engines. However, that decision came after extended and expensive experience with them. In 1911 it bought a *simple* (unheard of then) articulated 2-8-8-2 from Alco, followed it with a Baldwin 0-8-8-0 compound in 1912. The Alco HH-1 came off the roster in 1929, followed by the Baldwin CC-1 in 1931. The road's most successful true Mallets [i.e., compound] were its last: 10 CC-2 class Baldwin 0-8-8-0's built in 1919 for heavy pushing and hump service on Lines West. Incidentally, "C" is the PRR's classification letter for 0-8-0's, so the CC-2 designation simply meant 0-8-0+0-8-0. The engines were designed to negotiate 18-degree curves and climb hump yard grades up to 5 per cent. With all of its engine weight available for adhesion, the CC-2 developed 100,000 pounds tractive effort. Used in road helper service for a time, all 10 were eventually assigned to Columbus, O., have been scrapped after 30 years' service.

Action photo by Glen Grabill Jr., Rail Photo Service; still by Paul Ellenberger.



SIMPLE 2-8-8-0

By all odds, No. 3700, the sole example of the class HC-1 [i.e., 2-8-0+0-8-0] single-expansion 2-8-8-0 on the PRR, was the road's most impressive venture with jointed locomotive design. Built in Altoona in 1919, No. 3700 had a long, long firebox (14 feet) fronted by short 19-foot boiler tubes. Each of the cylinders had a separate exhaust nozzle with four stacks enclosed in the single casting housing on the smokebox. Taking a cue from I-1 2-10-0 experience, the HC-1 was arranged with 50 per cent cutoff in full gear to permit compound economies when working at speed. No. 3700 pulled out existing couplers in Allegheny Mountain service, spent too much time in the shops, was retired by the PRR in 1928.

The song of the Shay

Twice a day the "screwdrivers" of the Camino, Placerville & Lake Tahoe sing their concrete-mixer theme on their way to and from the timber

BY W. H. HUTCHINSON

PHOTOS BY MAC LE FEBRE

THE canyon-cramped community of Placerville (named Hangtown in more robust times) is steeped in the color and romance of California's golden years. The ghosts of plodding immigrants, Concord-coach skinners, Pony Express riders, and jerk-line freighters throng the transcontinental highway, U. S. 50, that crosses the Mother Lode highway, State Route 49, in the center of the town where, in early days, outlaws were so numerous they were hanged in pairs.

Placerville also is the western terminus of the Camino, Placerville & Lake Tahoe Railroad, which twice a day fills the main street canyon with "the Song of the Shay," a rolling stack blast like a helper Mallet singing alto. After 46 years of conditioning, Placerville and its citizens regard the CP&LT as an eccentric relic. In this case, familiarity breeds neglect of the road's unique position in the rail world.

The Camino, Placerville & Lake Tahoe Railroad is a full-fledged class 3 road with two vowels in its name for every mile of main line. It is the shortest standard-gauge in California, with enough curves and gradient to keep a Rio Grande Southern man from boredom. It is probably the only I.C.C. road whose engines never turn around. Its rolling stock and motive power combined total just four pieces: two Lima-built, triple-cylinder, three-truck Shays, a flat to keep the bridge and section gangs supplied, and a homemade hack that has known glorious days. More unusual than its length, directional foibles, terrain or equipment is the fact that the CP&LT originates some 40,000 tons of interline revenue freight a year in normal times. Like every short line, it has a legend to explain its pint-size proportions.

In 1903, so the story goes, a group of San Francisco investors banded together to give California another rail link across the High Sierra and thus bring Huntington's Octopus to terms. They started construction east from Placerville, where SP's Folsom branch terminated then and now, and by the fall of 1904 the Placerville & Lake Tahoe had climbed 1250 feet in eight miles to Seven-Mile Station on the famous Pony Express route. Here, the investors' exchequer and enthusiasm laid down and died at the pros-

Shay No. 2 flails its vertical monkey motion as it drifts downhill into Placerville at the end of a run from Camino. No. 2's three cylinders turn a shaft that is geared to the trucks. Its boiler is placed to the left of center on the frame to balance the weight of the pistons.

pects still ahead. It is a good story, but the facts don't bear it out.

The road was started and finished to destination for the same purpose it serves today — putting finished lumber from the purple trunks of California sugar pine into the national economy. The El Dorado Lumber Company, predecessor once-removed of the present owners, Michigan-California Lumber Company, took delivery from the contractor in November 1904. With very minor changes, the 8.05 miles of main line on its natural rock, seven-shale bed takes the same 72 curves, bucks the same average 3 per cent grade, with one 5 per cent hump, and crosses the same eight timber trestles that it did when No. 1 made the first revenue trip over the line upon completion of construction. The major operating differences today are 75-pound rail in spots (55 to 60 pounds is standard), oil for fuel instead of wood, and no passengers, mail or express.

Completion of the rail line gave the mill town of Camino, neé Seven-Mile Station, a dependable, all-weather link with Placerville, the county seat and supply center. The wagon road that followed the old immigrant trace down the ridge was hub-deep in summer dust, and when winter came it was impassable, not even jackassable. The Placerville & Lake Tahoe inaugurated passenger service in April 1905, took on a mail contract and began handling express and l.c.l. shipments.

The frame of a "foreign" box car was shortened by eight feet, then rebuilt into a caboose with sliding side doors to facilitate loading and discharge of passengers and goods. Regular fares between Camino and Placerville were 75 cents one way, $1.25 round trip; special excursions were run each week during baseball season with round-trip fares of 50 cents, and during the winter months three special shopping trips to Placerville were run for Camino's housewives. But, as the highway became improved, passenger service and traffic fell off and the mail contract was let to a highway carrier.

The I.C.C. permitted formal abandonment of passenger service in 1937, but the last revenue passenger had been carried some 15 years before, according to Edgar Kimble, who has held down the right-hand side of the Shays since February 1907. The last passenger was a prosaic chicken farmer of Smith Flat who did not want to walk his eggs the two miles into Placerville. He was short of cash, so

The angle of the photo may exaggerate the incline, but there's still plenty of steep climbing to be done on the CP&LT by Shay and train. Here No. 2 pauses to wait for the section gang.

the train crew charged him one dozen eggs and that was that. Some express and small freight shipments are still carried but they don't crowd the crummy when the crew uses it as a lunchroom during the layover time in Placerville.

The only interruption in the road's career came between 1909 and 1911 when the original lumber company fell upon evil days financially and suspended operations. Since there was no lumber to be hauled, there was no need for the daily schedule, and no money to pay the train crew. Edgar Kimble built himself a gas-powered rail car, one of the first in California, and maintained passenger service at excursion rates the year 'round during the hiatus. When he had enough cash on hand for operating and family expenses, the rides were free until economic necessity invoked the tariff again. The P&LT suffered the ignominy of a sheriff's sale on December 28, 1911, and was purchased by the CP&LT, whose stock was wholly owned by Danaher Pine Company, one of the outfits merged

No. 2 takes water at Blakeley's Spring, a privilege granted the road in 1904 in return for a permanent pass for the owner of the spring and members of his family, current and anticipated.

into the Michigan-California Lumber Company of today.

The same spirit that moved Ed Kimble to his personal passenger service rules the road today. You feel it riding the train, helping the section gang unload part of the year's 3000 ties, hanging in the gangway listening to the Shay eat up her daily quota of 400 gallons of fuel oil, and visiting with the trainmen during lunch and in their homes when the run is over. You get the feel of the road, and you get its intimate history which has never been put into writing.

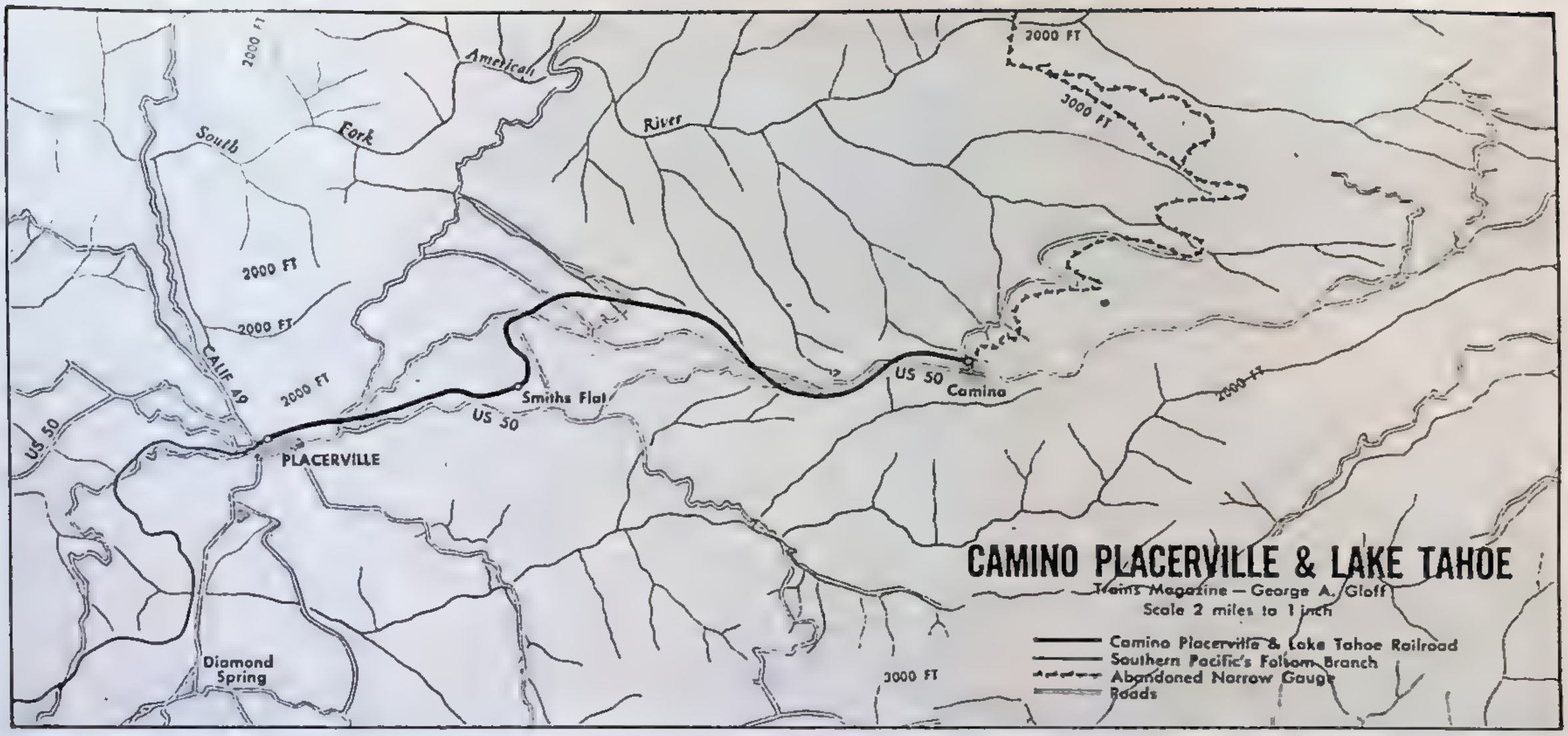
No. 1, a 60-ton Shay with 42:24 crown pinion ratio, was especially built by Lima for the St. Louis World's Fair in 1904. The P&LT bought her off the exhibition stand and she has been in service ever since. The years have only brought her modifications to suit the road's mechanical and personal requirements.

As she came into service, the regular air intake at the back of the firebox was not sufficient to keep her from "choking down" on the sustained climb up from Placerville. The train crew and the master mechanic for the lumber company discovered that the engine exhaust and the stack were out of line by three inches. They rectified this error but it still was not enough. Then they cut a new air intake all the way across the front of the firebox and this did the trick. However, a pronounced increase in the number of fires along the right of way accompanied this achievement. (The foothill grass is tinder-dry by mid-May each year.) Some applied research revealed that grasshoppers in great numbers were being sucked into the firebox through the new intake and then spewed out the stack, red-hot and still wiggling, despite a screen between petticoat and flue. A piece of heavy wire mesh was brazed over the new intake and operations returned to normal.

In her first few years of operation, a round trip with No. 1 without a broken journal was regarded as a moral victory. This was finally remedied by jacking her up and moving the centerpiece as far to the left as it would go, about four inches, to get a better balance against the weight of the cylinders and shafting.

After bitter experience and much strong language, the problem of keeping No. 1 on the rails when she was slogging into a curve was solved very simply. Long, curved pieces of half-

Crewmen on Southern Pacific's Folsom Branch local like to call the CP&LT Shays "screwdrivers" because of their relatively unusual method of propulsion. The SP diesel (Baldwin-built No. 5204) connects with the CP&LT at Placerville.



inch pipe were welded onto the engine frame so their tips rode just inside the flange on each wheel. These pipes were and are filled with waste and oiled religiously during the run. The knuckle-busting business of jacking her back is no longer an operational commonplace.

No. 1 still has no air herself; she uses a steam jamb when running single. However, she came with an 18″ x 72″ reservoir for train air which seemed adequate to Edgar Kimble when he took her over.

It was not adequate shortly thereafter to the replacement he was breaking in before Jack Williams joined him in the cab. The fireman serves as a relief hogger on the CP&LT. They left Camino in front of nine cars of green lumber and the new recruit made his first application when they cleared the yard and he felt the grade snatch at her. He kept it on, too, with the inevitable results which caused him to move over on the left-hand side after Kimble got her stopped. There was a convincing ring in his voice when he swore, feelingly, that he would never, never, never, take her down the grade again.

Kimble and the master mechanic talked it over and decided they had better do something about it. The result is the present reservoir, 28″ x 72″, on the right running board.

When No. 1 went over to oil in 1907, an oil tank, 50″ x 59″ x 100″, took the place of the wood basket behind the cab which gives the tender its disjointed look. Finally, the boys got tired of what they had to do every time they wanted to look at her innards. They cut the steam dome in half and made it detachable at will for inspection purposes and kept it tight at the same time.

Other than these modifications, plus some additional transverse frame braces, lengthened injection rods, and homemade big-capacity journal grease cups, No. 1 is just the way Lima turned her out. When No. 2, Lima-built in 1922, entered CP&LT service in 1936, coming from Hammond Lumber Company in the coastal redwoods, the guinea-pig work on No. 1 was applied to her instantly. Both work at 200-pound pressure, but Onespot blows at 203, and Twospot at 205. A girl has to have some individuality! Neither of them has a builder's number on the builder's plate, nor anywhere else that one writer and one photographer, assisted by a four-man train crew, could discover.

Every winter in their turn, the Shays get their tires turned, shaft brasses lined, their 12″ x 16″ cylinders, present measurement, rebored if necessary, and any other repairs that Kimble or Paul Savage, unofficial superintendent of motive power, think are indicated. What one of them doesn't know about a Shay, the other does. And when they need new parts, they make them themselves in Michigan-California's shops.

The CP&LT is a road where the trainmen shove off into the wild blue yonder without having their thinking done for them along the line. A private telephone line does parallel the track, but "We only wait for them to call us and they don't do that unless it's something they can't handle themselves."

One of these few instances came when the crew cut out the flat loaded with bridge timbers at Trestle 2, a mile above Placerville, for the bridge gang to unload. They were oiling around No. 2 in the Placerville yard when they heard the flat coming down the line. Kimble looked at his fireman and, just like Casey Jones, he said "Jump, and into the ditch at that. Those timbers are 16 x 16 and you've got a head up."

He followed his own advice and both men waited in the shallow ditch, digging in with their noses, expecting the worst. It didn't happen. The flat hit head-on, the bridge timbers kept moving forward as expected, but beyond having her air tank taken off and her petticoat mashed into the flue, No. 2 stayed together. What the train crew said to the bridge gang for letting the flat get away was more explosive. Even more disheartening is the fact that nobody had presence of mind enough to get a picture of a Shay-doubleheader when No. 1 dragged her ailing sister home.

The daily schedule, five days a week the year 'round (Michigan-California stores dry lumber for shipment on a year-long basis), calls for departure from Camino at 9:30 a. m., give or take whatever time is necessary to finish making up. With one stop for water at Blakeley's Spring, plus whatever way switching is required at Smith Flat, Placerville hears the Shay between 11:30 and 12. After lunch, juggling whatever the SP meet has brought in, the up-trip rattles every rafter along the line until it pulls into Camino between 3:30 and 4. If sand gets into the journals and they run hot, a hose from the tender, especially adapted for the purpose, sprays a cooling stream until they quiet down. The rest of the day is devoted to yard

switching among the 14 loading spurs at Camino, all under cover to keep the lumber dry, and whatever train make-up can be handled before morning.

The down-consist can reach 18 cars, provided there are enough loads of box shook or dry lumber to give braking power. A car of green lumber does not have the brake to hold herself. Even with train air to augment the steam jamb on the Shay, Calvin Christian, front, rear and swing brakeman, and Frank Fitzlaff, "conductor, road-master, junction freight agent and son-of-a-conductor," get their exercise in the time-honored manner — setting them up by hand.

The up-consist maximum, dictated by experience, is nine empties plus the hack. The train limits may not sound impressive, but in a working year the Shays handle 2000 cars over their own road plus whatever way switching they do in the Placerville yards for others during fruit packing season.

There have been no fatalities on the CP&LT in its history. Beyond the sad case of the flatload of bridge timbers, there has been only one other equipment casualty. This came from a spread rail that let a foreign car tip down the embankment above Trestle 3 and saw the load inside scoop its top off as it responded to the law of gravity.

One serio-comic occurrence deserves a place in the CP&LT folklore. A nameless fireman, typical, let the oil tank overflow at Camino one bright morning. The whole train was slicked up when they hit the stretch called Rupleley's Flat, halfway down the grade. It was spring in California and the section gang had not burned off as yet. The grass was green, full of moisture and waving gently over, around and between the rails. The next three miles were covered by a process of tobogganing, highly esteemed in winter sports circles but not recommended with or in a Shay packing 200-pound pressure.

For many years, the CP&LT had its own feeder line. This was 19 miles of narrow-gauge, using two-truck Shays, that connected the finishing mill at Camino with the head-rig at Pino Grande (pronounced "Pye-no Grand"). The American River canyon intervened and the "bobbies," link-and-pin couplers, 23 feet between drawheads and 7 feet wide, went over this chasm on an aerial tram, 2640 feet long and 900 feet above the river bed at cable sag. The south tower of the cable recently burned, and diesel trucks took the place of the Shays as the connecting link. If you want a narrow-gauge Shay for your private road, write Michigan-California Lumber Company; it has some bargains.

Engineer Edgar Kimble (with oilcan) and Fireman Jack Williams take time after lunch to oil around No. 2, getting it ready for the upgrade run to Camino. The canlike objects on the rod bearings are homemade grease cups which hold plenty of lubricant for the thrashing bearings.

As a duly regulated common carrier, the CP&LT must do what it would rather not — in this case, accept inbound interline freight. Since inbound means upgrade, its position is understandable if not tenable. However, there isn't much, if any, of it these days, except the empties that are the lifeblood of the road. But let it stand in the record that the CP&LT is more than an anachronistic adjunct of a lumbering operation.

During World War II, the CP&LT acquired another customer when Placerville Lumber Company built a molding and finishing mill at Smith Flat, only way station on the road. This operation is still going strong and the Shays deliver the empties and pick up the loads that start its long-haul shipments on their way. The way things look now, defense orders may again almost double the CP&LT's annual tonnage.

SHAY locomotives were invented in 1879 to meet the needs of lumbering and mining concerns whose trackage was laid on steep grades. The Shay's gearing gives ample power to crawl up the hills. The Western Maryland uses a three-cylinder Shay, built in 1945, on a coal mining branch near Chaffee, W. Va. This engine is designed for regular operation on 7 per cent grades with occasional stretches up to 10 per cent. It can haul 156 tons at 10 miles an hour on the 7 per cent grades.

And the road has another function, too. Placerville is the home of one of California's largest deciduous fresh-fruit packing plants. This operation ships tens of hundreds of cars during the season, mostly for eastern markets. The SP's Folsom branch serves this plant, but the Shays do the switching for the loading docks after the SP has gone back to Sacramento. The Shays and their road have a vital part in the rail net of the nation, and their four-man crew manages to disregard the scurrilous epithets hurled by the crew of the SP daily freight who dub the Shays "screwdrivers."

After spending some days with the CP&LT and the men who operate it, you come away with a warm feeling. Michigan-California Lumber Company cuts on a "sustained yield" basis from its forest holdings. This assures a continuing flow of lumber through head-rig and finishing mill that has to get to market somehow. Since the bulk of the cut goes to mid-western and eastern markets, rail is the way it moves.

There is, of course, nothing the Shays do that a diesel road-switcher couldn't do. But the Shays are on hand, in good condition, with trained personnel to run them. In addition they are free and clear of the initial cost factor. It would be a shame if the CP&LT went antiseptic, but from what could be learned, the "Song of the Shay" will bounce echoes off the California foothills, and loose rocks from the banks of the cuts, for many a year to come.

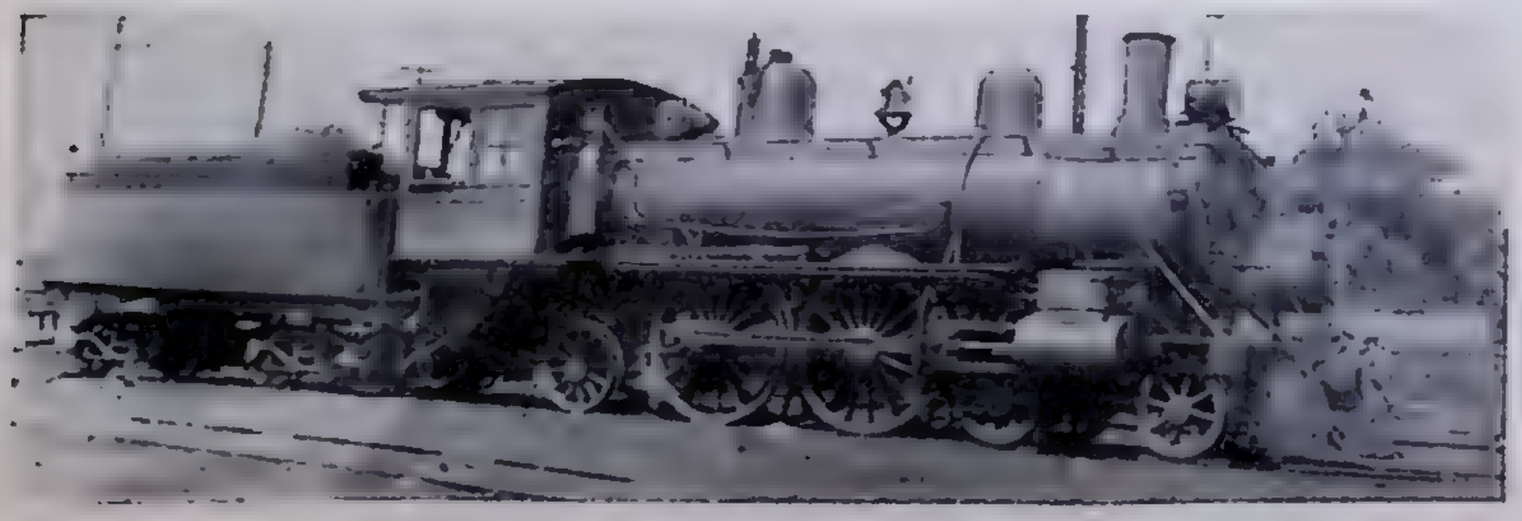
Jim Greenway Jr.

When the Yosemite Sugar Pine Lumber Company ceased operations in 1943, the doom of the Yosemite Valley Railroad was sealed, for the road depended heavily on the mill for traffic. The line was abandoned in 1945, shortly after train No. 3 was photographed coming out of Tunnel No. 1. The YV's 78 miles of track connected Merced, Calif., with Yosemite National Park.

Locomotives of the Coast Line

Electro-Motive road diesels are rapidly replacing Atlantic Coast Line's fleet of dual-service 4-6-2's

Columbia type No. 93 rides the table at Fayetteville, S. C., in a rare old photo of 1924. ACL received two such 2-4-2's from Baldwin in 1895 and ran them between South Rocky Mount, N. C., and Florence, S. C., in fast passenger service Poor adhesion was the downfall of both engines.



Baldwin's William P. Hensey designed the 4-4-2 to answer criticism of his Columbia locomotives. ACL bought the first five Atlantics in 1895 and identified them as class I. No. 89 is shown here in her old age, after she had lost her shaded lettering, capped stack, spit-and-polish.

DATA FROM GEORGE W. PETTENGILL JR.*

A PARADOX in motive power is the Atlantic type. Originally built by Baldwin in early 1895 for the Atlantic Coast Line, the high-speed passenger wheel arrangement was traditionally named in honor of the first road to buy it. It would also have been traditional for Coast Line to have pushed the 4-4-2 to the zenith in locomotive engineering it finally reached as the Pennsylvania E-6 and the Milwaukee Road A. But ACL found the engine it was looking for in the Pacific. And it is the 4-6-2, not the 4-4-2, for which the 5562-mile carrier is remembered in the fading realm of steam. Coast Line worked its varied classes of Pacifics on limiteds and hotshots alike years before the dual-service era, which found its birth and death with the American Standard, was returned to railroading by latter-day 4-8-4's and Challengers. Except for switchers and a few Mikes, 2-10-2's and Decapods, ACL's prewar roster was filled almost entirely with

*Photos by Pettengill unless otherwise credited.

David H. Noble.

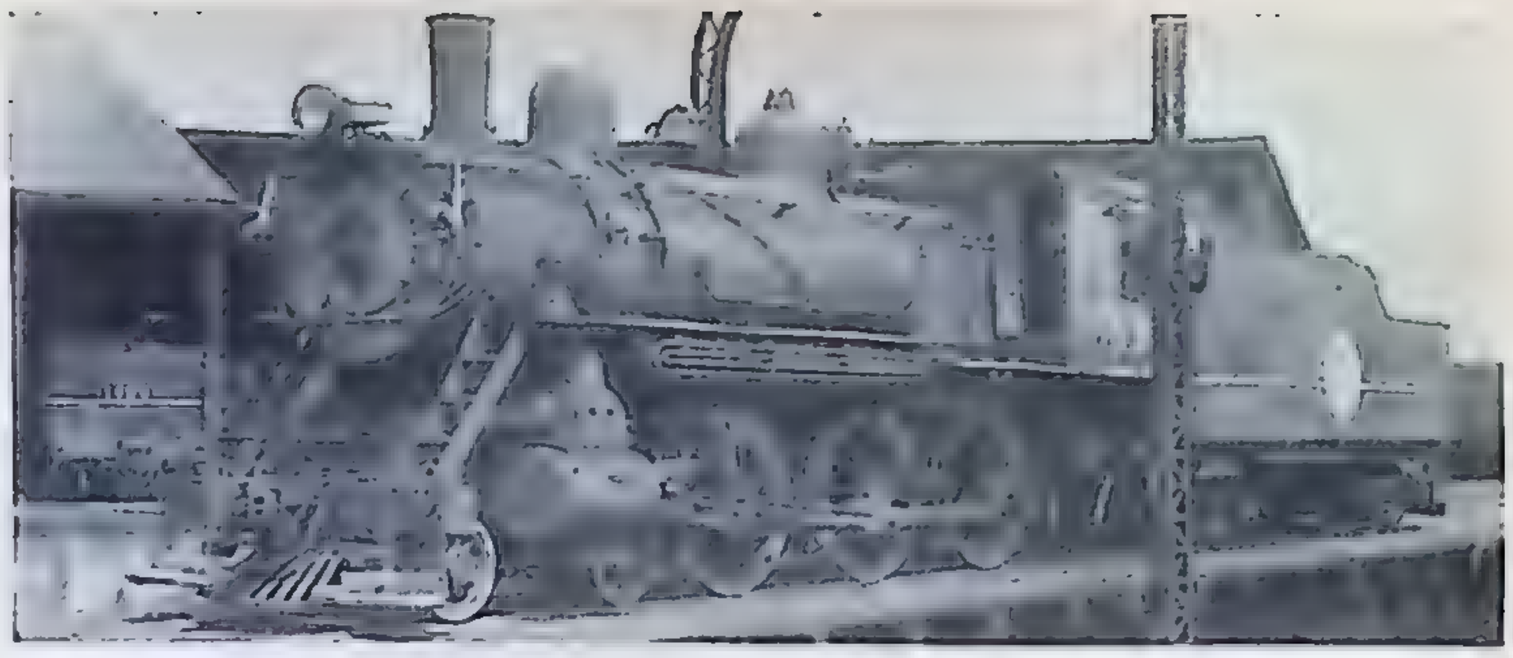
↑Northbound Everglades roars out of Weldon, N. C., behind EMD E-7 and E-6 model cab units.

Pacifics and their immediate forerunners, the Ten-Wheelers.

ACL purchased its last new steam locomotives in 1938. After that it followed the lead of its old rival in the East Coast trade, Seaboard Air Line, with a new power program charted toward 100 per cent dieselization.

The war and its aftermath set up a second Coast Line power paradox. Unable to obtain enough new diesels to assist its existing locomotives in hauling the battle load, ACL had to lease 33 steam engines from other roads. Five of them — ex-Lackawanna 4-8-2's — are still down in Dixie. Then, in 1946, the purchase of the Atlanta, Birmingham & Coast by ACL added another new variety of motive power to the big system's standard stock of 4-6-2's.

In 1950 Atlantic Coast Line looks forward to the October delivery of a $10-million, 73-unit Electro-Motive diesel order. The many Pacifics slated for scrap with receipt of EMD E-8's, F-7's and GP-7's leave ACL's service only after a full and useful life.



Straight-boilered K-6 Ten-Wheelers pioneered the Coast Line's dual-service era for which its Pacifics later became famous. Baldwin built a fleet of 4-6-0's between 1904 and 1906, and several were superheated after World War I. No. 359, with white flags at Lakeland, Fla., is now scrapped.

This 4-6-0 is one of a group that was returned to the Baldwin Locomotive Works in 1920 for a complete reconstruction including application of a superheater, piston-valve cylinders and Baker valve gear. No. 386 was photographed in 1939 before ACL's circular herald was on tank.

K-14 4-6-0 No. 254 bears faint traces of older Norfolk & Western designs. Baldwin built 10 such locomotives for passenger service in 1910; the piston valves and Walschaerts gear were added in 1920. Only four K-14's are left. They are employed between Wilmington and Fayetteville, N. C.

ACL's first Pacifics were three ex-Plant System engines built by Rhode Island in 1893 for the Milwaukee Road and later converted by ACL into 4-6-0's. ACL's own first 4-6-2's were 15 P class engines like No. 263. Originally these Baldwins had slide valves; all are scrapped now.

Continued on following pages.

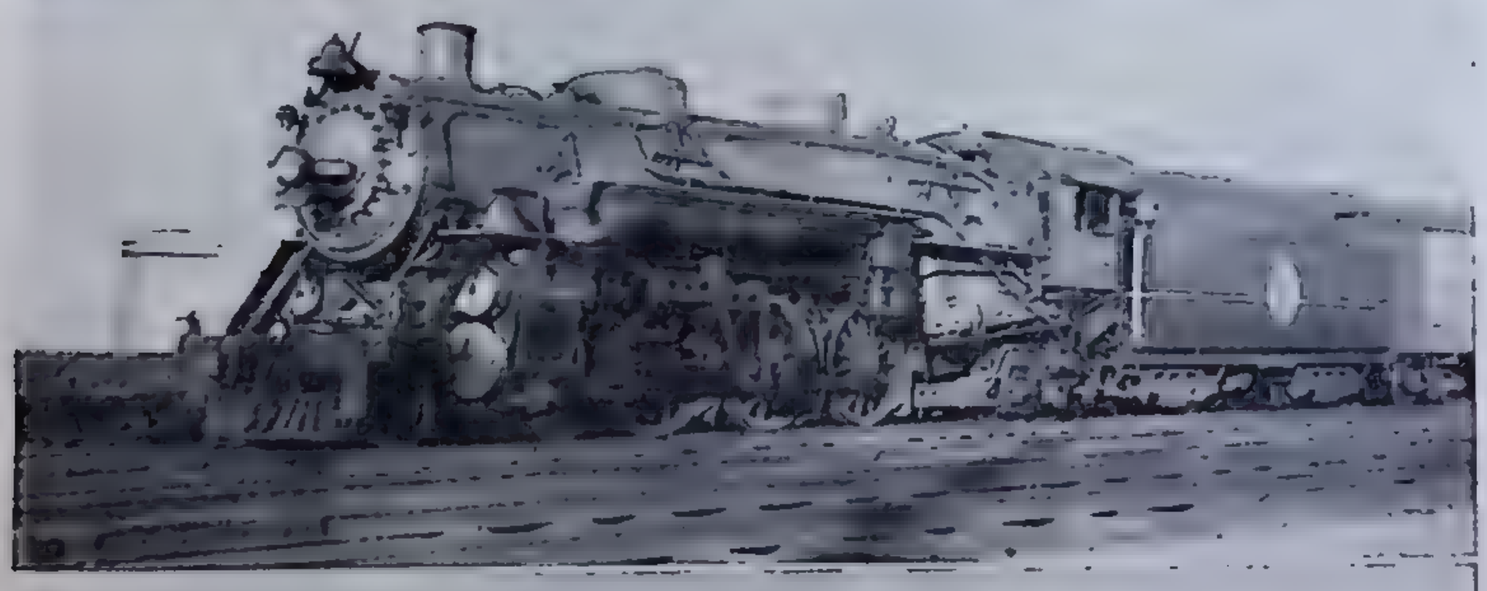
P-4 PACIFIC

Coast Line 4-6-2's gathered strength in tractive effort and number through the P-1, P-2 and P-3 classes. The acme of ACL's own designs was the P-4, series 456-482, which Baldwin built in 1917-1918. Like all of the road's original-design Pacifics, the P-4 features bell between domes, single-window cab, centered headlight, top-feed injectors, thin sand dome.

P-5a PACIFIC

In 1918 a government allocation of 45 Alco-built Pacifics of light U.S.R.A. design put the large Pacific on Coast Line rails. ACL added 25 more by 1920 to complete series 1500-1569. No. 1530, a P-5a modified with A.T.C. and feedwater heater, carries her *Palmetto Limited* insignia in the very best pre-diesel tradition. All P-5a Pacifics are equipped with Baker valve gear.

Wiley M. Bryan.



P-5b PACIFIC

ACL translated the light U.S.R.A. 4-6-2 into the dual-service unit it wanted by cutting driver size to 69 inches and increasing boiler pressure to 210 pounds. Baldwin built 165 units (series 1600-1764) between 1922 and 1926. Nos. 1670-1764 have Delta trailing trucks, while many P-5b's have been equipped with one-piece cylinders and feedwater heaters.

J-1 MOUNTAIN

Coast Line had to lease DL&W Mountain types 1401-1405 under the pressure of war traffic but did not wish to keep the Brooks 4-8-2's. When another road offered to buy them outright from DL&W, ACL had no choice but to buy up its option, thus adding a new wheel arrangement to its roster. J-1's are equipped with feedwater heaters, retain DL&W numbers.

W. R. Hicks.

R-1 NORTHERN

"No frills, no childish excrescences, just good design" was what Sam Vauclain said of the Baldwin-built 1800-1811 series of 4-8-4's. ACL bought the R-1's in 1938, the year rival Seaboard turned to 6000-horsepower diesels. R-1's proved rough, were the last new steam locomotives ACL ever bought. Improved by better counterbalancing, the 4-8-4's now haul tonnage.

SWITCHERS

A-DUMMY

The Baldwin Locomotive Works completed two pocket-sized A-Dummy shifters for the Coast Line: No. 1434 in 1905 and No. 1435 in 1912. Elder sister of the two 0-4-0's is shown at Montgomery in 1933. No. 1434 is now in storage and slated for scrap. Her passing will be mourned by rails and enthusiasts perhaps more than the retirement of many larger units.

Collection of Joseph Lavelle.

E-10 SIX-COUPLED

ACL has concentrated its dieselization program on road operations, buying diesel switchers only where there are 24-hour assignments for them. This policy has left all of the series 1100-1125 E-10 class 0-6-0's, as well as a good many older locomotives, on the active roster. The wooden-cab and slide-valve E-10's were built by Baldwin in the years 1912-1913.

E-13 SIX-COUPLED

Baldwin had no more faithful customer in steam power than Coast Line; all Alco-built steam power on the ACL roster was installed by directive of the U.S.R.A. in World War I. The E-13 0-6-0's, series 1146-1150, were built by Baldwin in 1920 to the same U.S.R.A. 0-6-0 specifications which Alco used in building 10 E-9 shifters for the Coast Line in 1918 and 1919.

Richard E. Prince Jr.

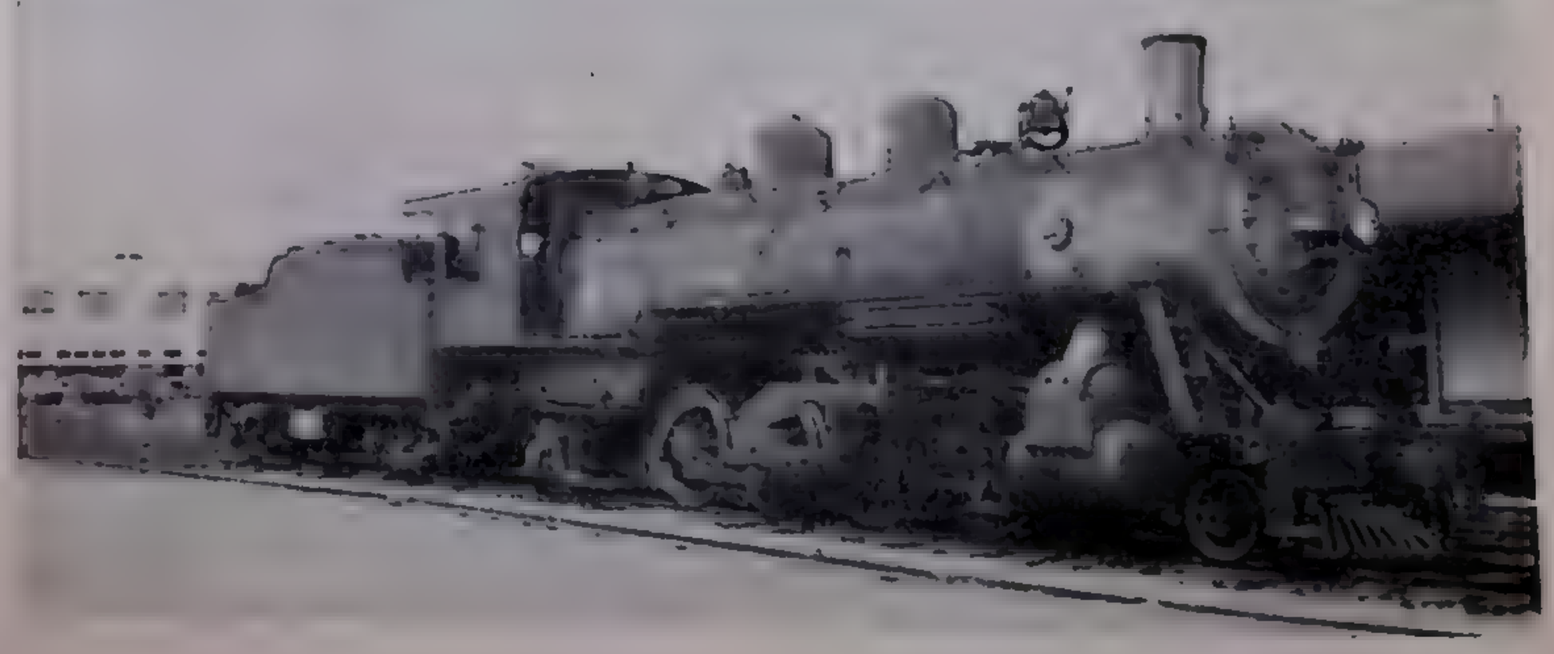
E-14 EIGHT-COUPLED

The E-14, Coast Line's heaviest and most modern steam yard power, has been called an "ideal" locomotive by ACL—which is a credit to the U.S.R.A. 0-8-0 design on which it is based. Baldwin built the E-14 series (1200-1234) between 1923 and 1926 and the only changes that ACL found necessary were in the pilot steps and the slant (for vision) of tank sides.

FREIGHT POWER

M MIKADO

Like the New Haven, Coast Line never acquired large numbers of the 2-8-2 type. The M class Mikes were the first engines of the type on the system; Baldwin built series 800-819 during 1911. The 56½"-drivered drag engines are good steamers and are well liked by engine crews in the southern districts, where they are still extensively employed on tonnage trains.



M-2 MIKADO

Largest 2-8-2's of Atlantic Coast Line's own design are 16 Baldwin-built M-2 class machines delivered in 1918, 1919 and 1923 in series 820-836. (One has been scrapped.) All of the M-2's are stoker-fired and superheated; five have been equipped with automatic train control and radio communication for work on northern districts. No. 836 is in St. Petersburg.

O DECAPOD

ACL's O class 2-10-0's, series 8003-8009, are known as the "Russian Bears." They were built by Alco and Baldwin in 1920 for Russia but were not shipped because of the Red revolution. ACL was allocated 10 when the U.S.R.A. seized them and redistributed them among engine-hungry U. S. roads. Originally five-foot gaugers, the high-boilered O's do work service.

W. H. Thrall Jr.

Q-1 SANTA FE

The only Vanderbilt-tendered locomotives on the ACL are also the line's most powerful steam engines: Q-1 class 2-10-2's, series 2000-2019, built in 1925-1926 by Baldwin. The Q-1's favor U.S.R.A. plans. Since their construction the Santa Fe's have been equipped with feedwater heaters and recounterbalanced for speeds faster than 30, their old maximum.

DIESELS

DEP E-7

Coast Line started buying passenger diesels in 1939, now owns 34 cabs and 15 boosters of 2000 horsepower each — all of Electro-Motive manufacture and painted in hues of purple and white. These E-6's and E-7's have taken over most of ACL's feature first-class assignments from Pacifics and 4-8-4's. EMD's first assignment was the streamlined all-coach *Champion*.

DES 1000 HORSEPOWER

ACL bought its first diesel switcher — Alco-GE No. 600 — in 1940, has since purchased 33 1000-horsepower units, mostly of Alco-GE build but including both EMD and Baldwin locomotives. Cost of operation and availability of its diesel shifters pleased ACL; its units now handle 34 per cent of all switching hours. It has nine 1200-horsepower EMD's on order.

DEF F-3

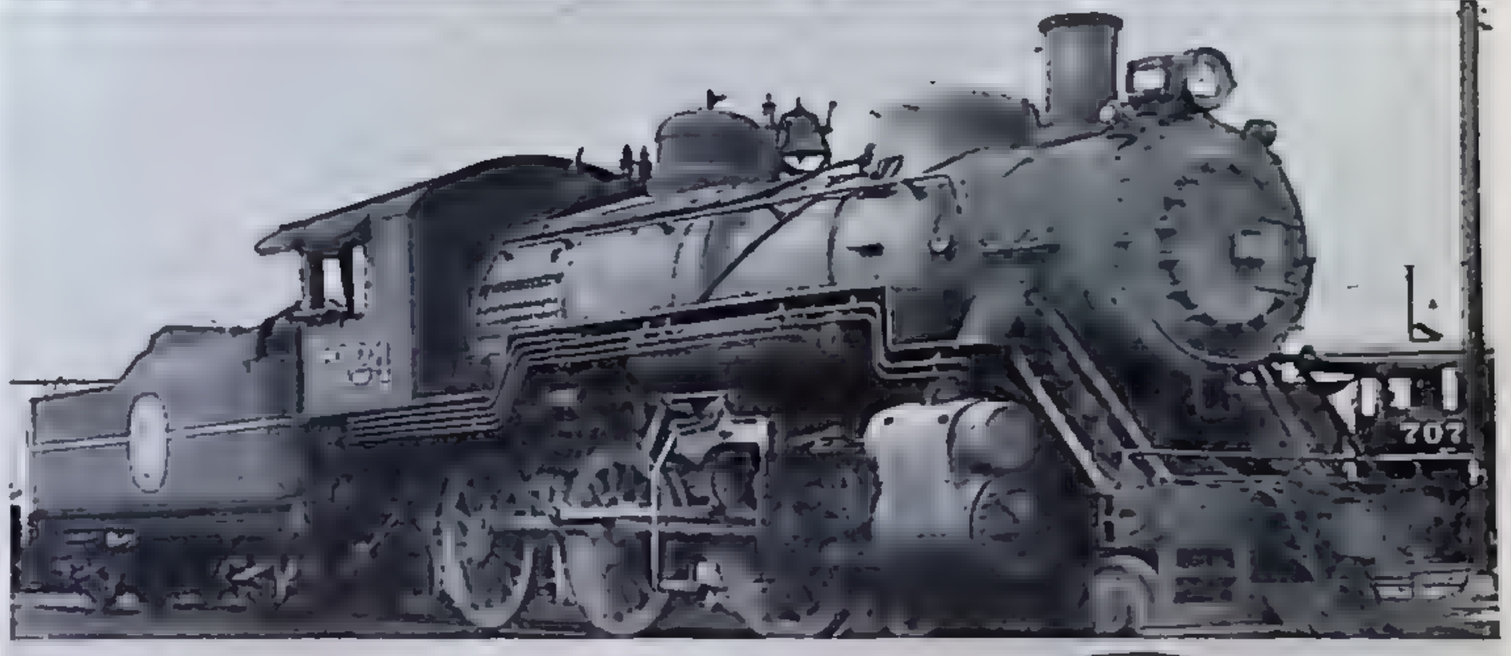
ACL operates 36 Electro-Motive FT and F-2 1350-horsepower cab and booster units and 12 EMD F-3 1500-horsepower "A's" and "B's." All are equipped with automatic train control. Normally a two-unit EMD is ample to handle tonnage over the easy grades of the Coast Line main. In 1948 these units handled 32 per cent of gross-ton miles, saved ACL $1.4 million.

James G. LaVake.

EX-AB&C POWER

AW-4 TEN-WHEELER

Coast Line didn't think much of the engines it inherited in 1946 when it officially took over the Atlanta, Birmingham & Coast. It called AB&C power "obsolete and far below Coast Line standards." The 7124 (ex-AB&C 124) was built by Baldwin in 1907. Obsolete or not, this machine is heavier and more powerful than any Ten-Wheeler that ACL designed for itself.



AJ-2 PACIFIC

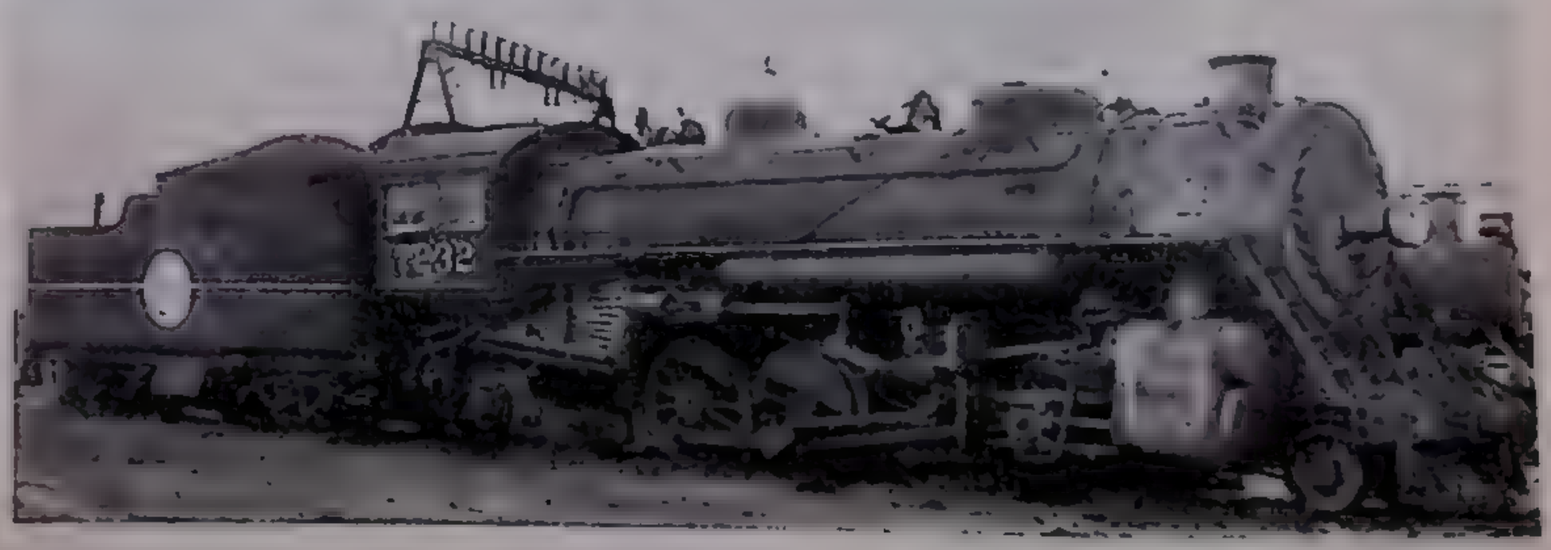
Pacific No. 7175 rolled under the ownership of three railroads before she finally wound up in this ACL scrap line. She was built by Lima in 1914 for the Great Northern, and still carries the GN traits: Belpaire boiler, above-center headlight, tender coal pusher anti-spreader. AB&C bought her during the war, but she managed to be repainted in ACL striping.

AM-1 MOUNTAIN

AB&C bought Mountain types 7351 and 7372 from the Florida East Coast, another line that ACL is trying to bring into its system. No. 7372, turned out by American Locomotive in 1924, stands in a line of stored power with a cover over her stack. As the biggest passenger engine AB&C had, she used to roll the feature *Dixieland* and streamlined *Dixie Flagler*.

AM-2 MIKADO

Mikado No. 7232 is one of nine New York Central 2-8-2's that the AB&C purchased after 1927 when ACL first assumed its stock control of the line into Atlanta. She was built by American in 1914, came in the improvement program inspired by Coast Line control years before the big system got around to taking over AB&C operations under its own herald in 1946.



Eight-Wheel Standard Locomotives

From a catalog of the Rogers Locomotive Works, 1886

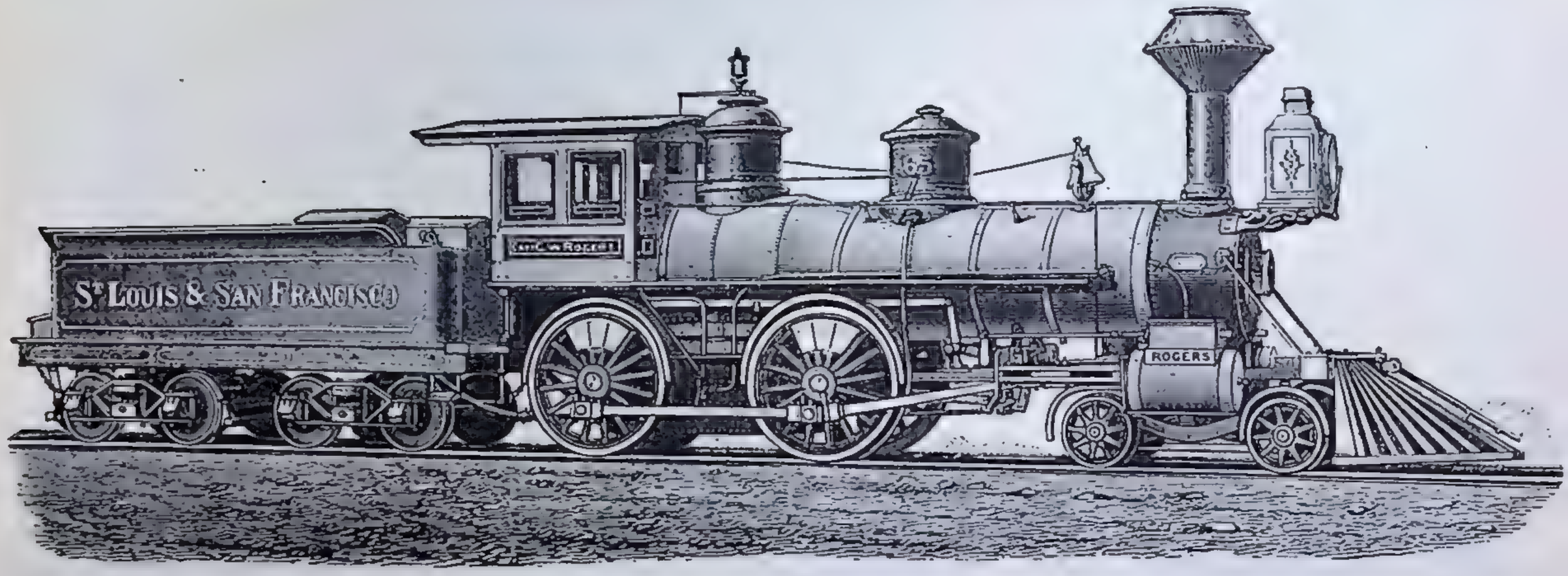


PLATE 1. Eight-wheel standard locomotive for passengers.

Cylinders Diameter and Stroke inches	Diameter of Driving Wheels inches	Wheel Base of Driving Wheels	Wheel Base Total	Weight, in running order on Driving Wheels lbs.	Weight, in running order on Truck lbs.	Weight, in running order Total lbs.	Separate Tender Capacity of Tank gals.
15 x 22	66	7′-9″	21′-4″	41,200	23,200	64,400	1800
15 x 24	66	7′-9″	21′-8″	42,200	23,400	65,600	2000
16 x 22	66	7′-9″	21′-7″	43,200	23,400	66,600	2000
16 x 24	66	8′-0″	22′-0″	44,200	24,400	68,600	2200
17 x 22	66	8′-0″	21′-9½″	45,200	24,400	69,600	2200

Gauge: 4′-8½″ or wider. Fuel, bituminous coal.

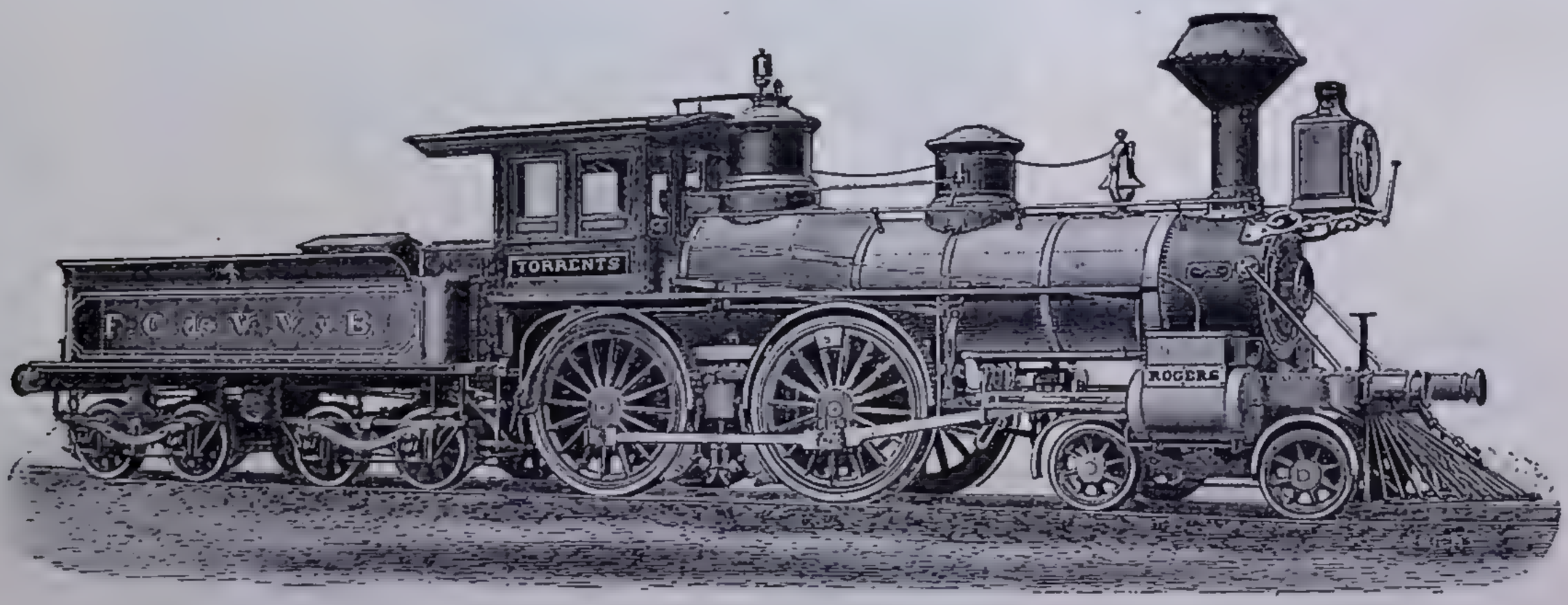


PLATE 2. Eight-wheel standard locomotive for passengers.

Cylinders Diameter and Stroke inches	Diameter of Driving Wheels inches	Wheel Base of Driving Wheels	Wheel Base Total	Weight, in running order on Driving Wheels lbs.	Weight, in running order on Truck lbs.	Weight, in running order Total lbs.	Separate Tender Capacity of Tank gals.
17 x 24	66	8′-6″	22′-8½″	48,700	27,000	75,700	2300
18 x 22	66	8′-6″	22′-6½″	49,200	27,200	76,400	2300
18 x 24	66	8′-6″	22′-11½″	52,400	27,600	80,000	2600
19 x 22	66	8′-6″	22′-7½″	53,000	28,000	81,000	2600

Gauge: 4′-8½″ or wider. Fuel, bituminous coal.

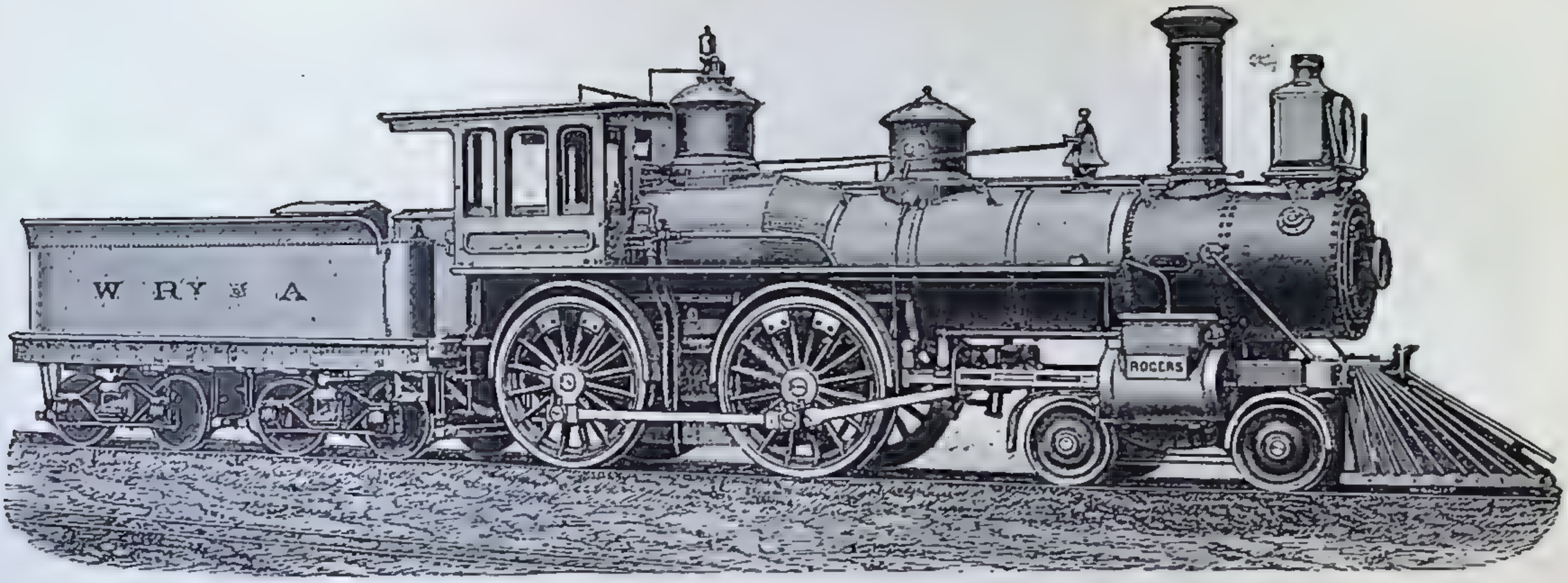


PLATE 3. Eight-wheel standard locomotive for passenger or freight.

Cylinders Diameter and Stroke inches	Diameter of Driving Wheels inches	Wheel Base of Driving Wheels	Wheel Base Total	Weight, in running order on Driving Wheels lbs.	Weight, in running order on Truck lbs.	Weight, in running order Total lbs.	Separate Tender Capacity of Tank gals.
15 x 24	56	7′-9″	21′-7″	41,000	23,000	64,000	2000
16 x 22	56	7′-9″	21′-6″	42.000	23,000	65,000	2000
16 x 24	56	8′-0″	21′-11″	43,000	24,000	67,000	2200
17 x 22	56	8′-0″	21′-9½″	44,000	24,000	68,000	2200
17 x 24	56	8′-3″	22′-4½″	47,500	26,500	74,000	2300
15 x 22	62	7′-9″	21′-3″	40,700	23,000	63,700	1800
15 x 24	62	7′-9″	21′-7″	41,700	23,200	64,900	2000
16 x 22	62	7′-9″	21′-6″	42,700	23,200	65,900	2000
16 x 24	62	8′-0″	21′-11″	43,700	24,200	67,900	2200
17 x 22	62	8′-0″	21′-9½″	44,700	24,200	68,900	2200
17 x 24	62	8′-3″	22′-4½″	48,200	26,800	75,000	2300
18 x 22	62	8′-3″	22′-3½″	48,500	27,000	75,500	2300

Gauge: 4′-8½″ or wider. Fuel, bituminous coal.

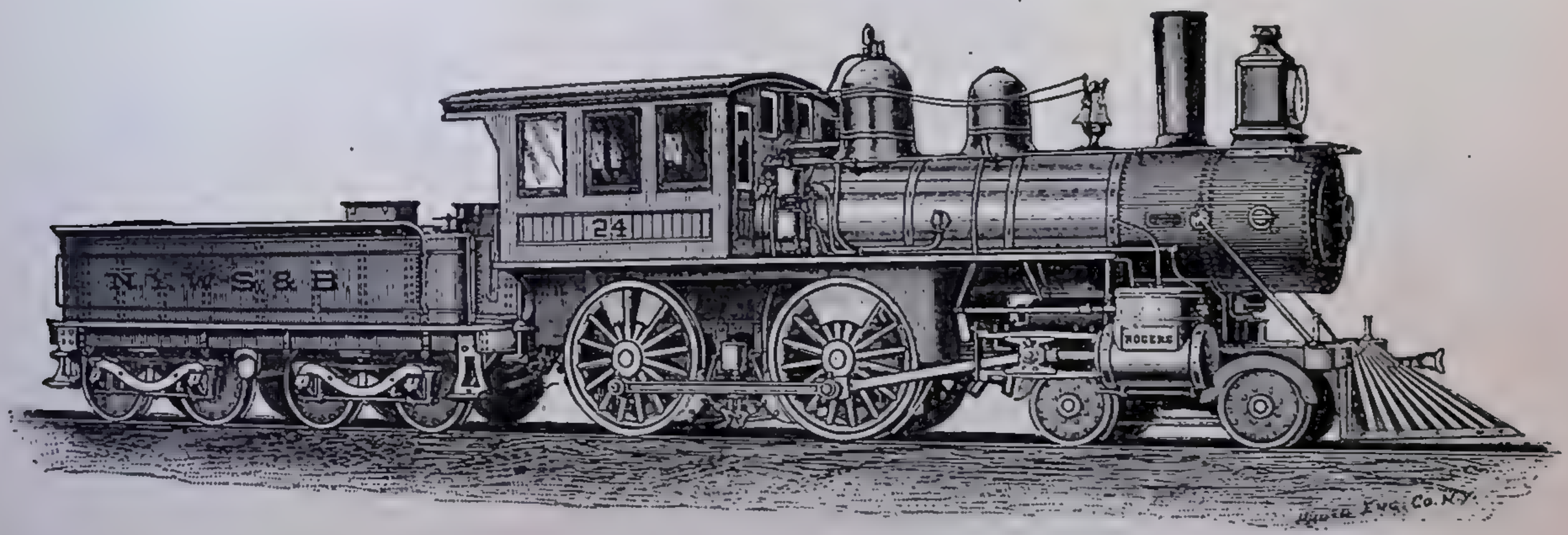


PLATE 4. Eight-wheel standard locomotive for passengers.

Cylinders Diameter and Stroke inches	Diameter of Driving Wheels inches	Wheel Base of Driving Wheels	Wheel Base Total	Weight, in running order on Driving Wheels lbs.	Weight, in running order on Truck lbs.	Weight, in running order Total lbs.	Separate Tender Capacity of Tank gals.
17 x 22	66	8′-0″	21′-11″	59,500	23,500	83,000	2200
17 x 24	66	8′-0″	22′-1½″	63,000	25,000	88,000	2300
18 x 22	66	8′-0″	21′-11″	63.000	25,000	88,000	2300
18 x 24	66	8′-6″	22′-9½″	64,000	32,500	96,500	2600

Gauge: 4′-8½″ or wider. Fuel, anthracite coal.

Ps-4

BY H. STAFFORD BRYANT JR.

Southern Railway's green-and-gold Ps-4's, first ladies of the Pacifics, were created in the classic tradition of "standard railroading"

THE so-called practice of "standard railroading," as it existed throughout the 1920's and the early 1930's, must then have seemed so lush, so wealthy and so complete as to defy any conceivable thought of improvement. The more substantial features of it, such as heavy double-tracked steel on thick rock ballast, automatic block signaling, reasonably fast manifest freight service, and the heavy, handsome Pullmans and coaches of the blue-ribbon passenger trains, were comforting to rail official, traveler and shipper alike. The diesel engine was then a propulsion system of uncertain future which a few railroads were trying out in switching locomotives; streamlining and lightweight metals existed largely in pseudo-science fiction. Doubtless, "standard railroading" would last forever.

Externally, progress in steam motive power seemed to be patterned in a complacent groove; but as one carefully scrutinized the builder photographs of the day he saw subtly revealed the nervous ferment of innovation in both engineering and styling. With regard to the latter, it was clear that a revival of the spit, polish and superb trim which so characterized the locomotives of the 19th Century was definitely at hand. It was in direct reaction to the drab locomotive years of the First World War.

Chesapeake & Ohio installed into service its ultra-aristocratic "flying pumps" locomotives, each resplendent with a multitude of brilliantly shined brass fittings on gleaming black boilers — an appearance of terrific power combined with handsome good looks. There was the roster of the Missouri-Kansas-Texas, gay and festive with bright Katy heralds and a wealth of trim; the commendable Baltimore & Ohio President Pacifics in green and

gold hues; the plush circus-wagon decorations of Richmond, Fredericksburg & Potomac's Pacifics and 4-8-2's.

Wabash outfitted 84"-drivered Atlantics with drop-coupler pilots, shined their jackets, streamstyled their tenders and set them to racking up some of the fastest passenger schedules in the world. There was the austere Gothic-window elegance of New Haven's I-4 class *Merchants Limited*-hauling Pacifics, the splendid dandification of Frisco's 1500-series 4-8-2's in blue jackets, delicate striping, large tender numerals, classical graphite smokeboxes, red and gold number plates and red-mouthed bells.

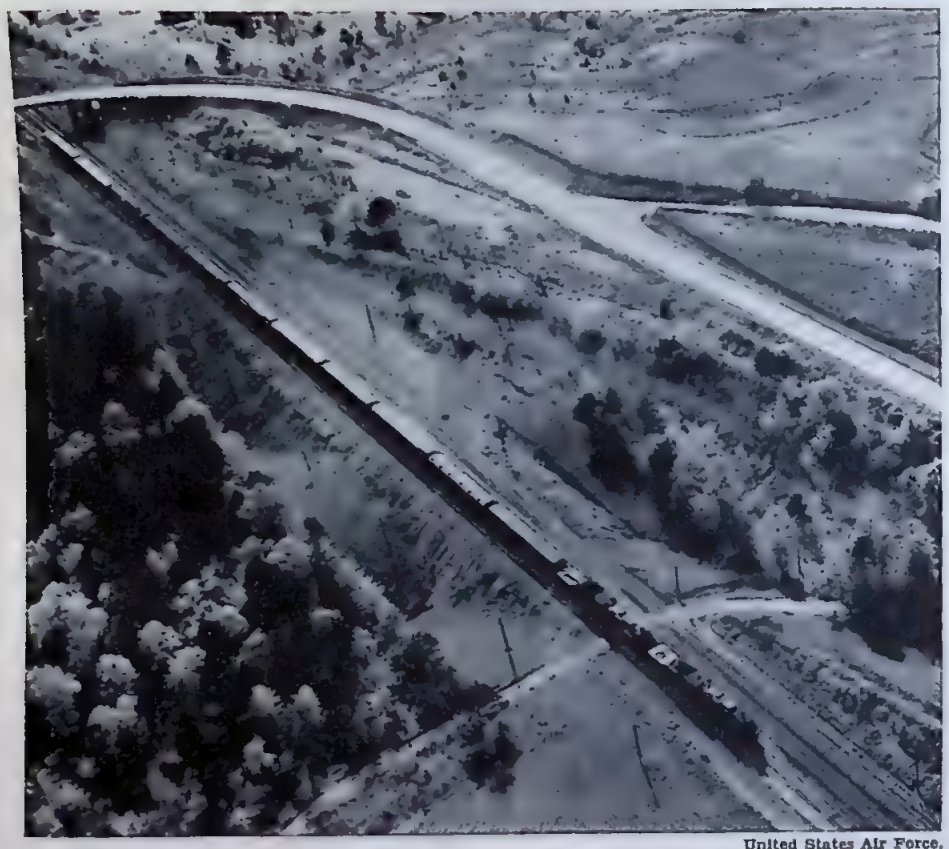
Delaware & Hudson tried the Continental approach, coming up with engines that were in their European lines distinctive if not always attractive to U. S. observers. New York Central and Pennsylvania distinguished themselves with locomotives that showed a sheer aesthetic perfection in basic line of design.

It remained for the Southern Railway, however, to have the signal honor of owning the most brilliantly styled steam designs of their day, the Ps-4 class 4-6-2's — first ladies of the Pacifics. The idea occurred to the late President Fairfax Harrison of the Southern while he was vacationing in England in 1925. He had seen steam locomotives of the Southern Railway (England) styled in a beautiful shade of light green* with trimmings of gold leaf striping. Why couldn't his own Southern, he mused, similarly style a group of heavy Pacifics it then had on order with the Richmond Works of American Locomotive? Further, he decided to have the tenders of several of the new 4-6-2's lettered *Crescent Limited* to better advertise the New Orleans-New York all-Pullman express. Harrison's ideas were to be supplemented by the then-standard SR practice of trimming wheel tires and running boards in aluminum paint, by number plates of brass with red backgrounds, by light-graphite smokeboxes and shipshape maintenance of metal "brightwork."

The plans were rushed to the works at Richmond, and all over the Southern they waited.

Harrison's notions proved a stroke of press agent's genius, astutely adapted to the tastes of a region long ac-

*Actually the Ps-4's are painted a shade of green much more like that worn by London & North Eastern engines.



United States Air Force.

Eight of the Southern Railway's great green-and-gold Ps-4 Pacifics were entrusted with the most solemn, most distinguished duty of the road in World War II: hauling the funeral train of President Franklin Delano Roosevelt from Atlanta to Washington. This aerial photo was taken near Clemson, S. C., on April 13, 1945, as Nos. 1409 and 1394 neared Greenville with their 11-car assignment. The Commander-in-Chief lay in state in the last car — the armored Magellan.

Richard E. Prince Jr.

Big, beautiful and bustling, Ps-4 No. 1401 thunders into Atlanta with the coaches and Pullmans of No. 29 from Washington. Crowned with an Elesco feedwater heater, the Richmond Pacific draws a 12-wheel, 14,000-gallon tender and was built in 1926. Odd number plate is CNO&TP style.

customed to colorful and immaculate motive power. One by one, the Pacifics arrived from Richmond — long, racy-looking, classy, and sporty with Elesco feedwater heaters and Commonwealth tender truck accents. The appearance of the Ps-4's in Atlanta, Cincinnati, Meridian, Spartanburg, Charlotte and Chattanooga attracted great crowds and netted the Southern an incalculable amount of favorable publicity. A Birmingham society woman admired their stunning attire, a civil engineer studied their mechanical potentialities, and a Washington (D. C.) railroad enthusiast spent his weekends taking photos of them with a Graflex. Most certainly an entire generation of southern boyhood was permanently and irresistably captivated.

Southern assigned its new Ps-4's to particular senior engine crews, which made for effective promotion of the road's long-famous "optional equipment" policy. Individual enginemen and shop employees were allowed to add certain adornments of their own choosing to the engines, thus producing in 20th Century SR power an unparalleled renaissance of the colorful in locomotive trim; the trend drew its inspiration directly from the diamond-stackers of the 19th Century. Brass "candlesticks" flanked headlights; eagles or Masonic emblems were mounted on smokeboxes; stars appeared on cylinder heads; brass rings became popular on stacks.

MECHANICALLY, the Ps-4 could accurately be termed the typical passenger locomotive of its time. In 1923 the Southern needed an engine that could handle up to 14 cars on fairly conservative schedules over moderate grades. A top speed of 80 miles an hour was wanted and the locomotives were to be capable of 80,000 miles between general overhauls.

The first Ps-4's, outshopped by Schenectady in 1923 and painted black, exhibited little that was experimental or innovational engineeringwise. Alco based them on sound, well-proven plans and tested appliances, selecting the heavy U.S.R.A. 4-6-2 as the fundamental blueprint. Grades encountered on many SR mainline divisions dictated that 73-inch drivers be used for a higher tractive effort rather than the 79-inch dimension of the government design. Other departures from U.S.R.A. standards included use of the roomier and high-sided standard SR engine cab, improved passenger tender trucks, and the single-unit model 3-B Worthington feedwater heater. Significant is the fact that Southern chose Baker valve gear (of U.S.R.A. in-

Walter H. Thrall Jr.

Long trains and long station stops were a measure of the Southern Railway tradition throughout the "standard railroading" era. Here, in September 1937, the Piedmont Limited bound for Atlanta pauses at Charlotte, N. C., while Ps-4 No. 1372 takes on a tank of water. She was one of the original big Pacifics on the SR, turned out by Schenectady in 1923. Here she features a saw-toothed stack, built-up coal cowl, Worthington feedwater heater, and Baker valve gear.

spiration) for use on the first Ps-4's; never again was the complicated Southern valve gear included on the specification sheet for a new series of SR locomotives.

As they were received from the builder, the new Pacifics supplanted older and lighter 4-6-2's and heavy 4-8-2's. This allowed SR to concentrate its Mountain types on such rough lines as the Spartanburg-Asheville district with its 4.7 per cent Saluda Hill and the hilly Knoxville Division.

Reflective of the road's present-day diesel policies, the original Ps-4's were impartially assigned to the various divisions and subsidiary companies of the system as traffic demanded and as trackage allowed. Nos. 1366-1392 were assigned to the SR proper; 6471-6475 went to the Cincinnati, New Orleans & Texas Pacific (Cincinnati-Chattanooga); and the Alabama Great Southern (Chattanooga-Meridian) assumed operation of series 6684-6687. Light axle loading restrictions kept the Pacifics off such subsidiaries as the New Orleans & Northeastern and the Georgia, Southern & Florida.

The 1926 Richmond batch of Ps-4's — the green-and-gold Harrison engines — displayed spectacular modifications. Elesco bundle-type feedwater heaters took the place of Worthington equipment; long-distance tenders were substituted for the 10,000-gallon U.S.R.A. tanks of the Schenectady Ps-4's. But the U.S.R.A.-influenced and rivet-fabricated trailer truck was retained with this second series of Ps-4 Pacifics. At this stage in SR Pacific progress it is interesting to note that Southern, almost alone among major American roads, never chose to apply the General Steel Castings Delta trailing truck to any of its locomotives although it found good use for other products of that company, including the six-wheel truck castings for its 14,000-gallon Ps-4 tanks. These 1926 Ps-4's were distributed all over the system: Nos. 1393-1404 went to the SR "main line" while CNO&TP took series 6476-6482 and AGS got the 6688-6691 set.

Baldwin built the last Ps-4's, series 1405-1409, in 1928. Excepting No. 1409, these final big Pacifics differed from their forerunners in having smaller tanks (four-wheel truck, 12,000-gallon capacity), smaller headlights and Walschaerts valve gear.

No. 1409, though, was different. Eddystone rolled her out with a Frisco look. There was something about her extended smokebox. She was the guinea pig of the Ps-4's, for on her Southern tried out its lone application of the Coffin enclosed feedwater heater. Often in the "standard" '20's one engine in an order would be fitted thus for the purpose of demonstrating a new appliance or valve motion. Even today you can spot No. 1409 a coal drag's length away by her long front end, even though the Coffin heater has been removed.

The decade 1928-1938 saw the first lady Ps-4's in their glorious, most fashionable years, racing up and down the Washington-Atlanta main line with the *Crescent Limited** and the *Piedmont Limited* and the *Aiken-Augusta Special*. They also handled the short Washington-Monroe (Va.) hops of the old *Memphis Special* (now the streamlined *Tennessean*) and *Birmingham Special*. From Alexandria they worked the long mail and express blocks off the Pennsy to cities across the South. On the CNO&TP the Ps-4's headed the *Royal Palm*, *Ponce de Leon* and winter-season *Florida Sunbeam*, as well as the one-time *Suwanee River Special* and the old *Queen & Crescent* of nostaglic memory.

Surely one of the most inspiring

*During the depression and until 1938 SR chose to soft-pedal *Crescent Limited* in its public timetables, calling it simply trains Nos. 37 and 38. Extra fare and apple green Pullman livery vanished too. Tanks of Ps-4's that once bore the name of the train (and cabs that had a crescent moon on the side) were repainted in standard dress. Nos. 37 and 38 are now known as the *Crescent*, are diesel-powered and have recently been streamlined.

F. E. Ardrey Jr.

Prima donna 1380 was streamlined by Otto Kuhler in 1941 to haul the new all-coach Tennessean from Washington to Monroe, Va. Bumped by diesels, but no less immaculate for her Cinderella fortunes, she stands in Spencer, N. C., awaiting call to head a local with her bullet-type nose.

sights to be seen in U. S. "standard railroading" was a winter morning run of the southbound *Royal Palm* and its regularly assigned Ps-4 No. 6482 up Erlanger Hill, just south of Cincinnati on the "Rat Hole Division." There was a wait, perhaps, in freezing cold or biting winds or maybe skin-soaking fog, but then . . . then a sun peeked over an eastern Kentucky ridge. There came the sounds of repeated steamboat whistling and of cracking exhaust, and from around a bend No. 6482 hit the bridge at the foot of Erlanger, working hard for the climb ahead. The Pacific, carrying an eagle on her smokebox and candlesticks about her headlight, was polished brilliantly; the combination of sun, fog and fissionlike amounts of billowing white smoke gave her green-and-gold bulk an appearance of most-regal majesty.

Monthly mileages for the Ps-4's during those years may not have been awesome, nor was horsepower performance great by "superpower" scales; but no steam power anywhere was ever more superbly maintained. If the Southern motive power organization ever envied the newer Hudsons and Northerns other roads were buying, it never, never showed it. The Ps-4's always looked good and an admiring South remained grateful to the road for them.

Years of diverse operating conditions for the Ps-4's and the optional equipment policy produced many minor modifications of engineering and adornment in the class. In later years, for instance, engines assigned to the Atlanta Division could be indentified by their deep, welded cab shades. There were different styles of striping, tenders and handrails. CNO&TP's Ps-4's were equipped with Wimble smoke ducts over their sand domes for operation through the subsidiary's many tunnels, as protection for both tunnel timbers and engine crews. These ducts, together with delicate striping and ornate number plates, made this 6471-6482 series particularly striking.

Down on the AGS there appeared a masculine version of the Ps-4, No. 6686, quaintly named *J. W. Turnipseed.* Mr. T. wore his name in gold letters on his valve gear hangers. Several other AGS and CNO&TP engines carried the names of the engineers who regularly handled their throttles.

IN 1941 a meteor struck the Southern, and the proudest days of the great Pacifics suddenly seemed over; their dignity was maintained but their prestige was gone forever. For in that year the road diesel passenger locomotive came and stayed. General Motors' ably promoted and easily demonstrated internal combustion machine took a promotion-conscious Southern by storm, and a great railroad experienced a technological revolution. New standards founded on availability and high monthly mileage went into effect. As the road gathered more and more diesels, the old Southern concept of assigning certain en-

F.D.R.'s final journey

THESE are the Southern Railway Ps-4 Pacifics and engineers assigned to the 11-car funeral train of President Roosevelt from Atlanta to Washington in April, 1945:

Districts	*Engine Numbers*	*Engineers*
Atlanta to Greenville	1409	C. E. Blackman
	1394	L. B. Griffith
Greenville to Salisbury	1401	O. L. Cooksey
	1385	O. B. Surratt
Salisbury to Monroe	1367	S. A. Shuping
	1400	O. L. Pierce
Monroe to Washington	1366	C. R. Yowell
	1406	T. S. Hunter

gines to certain divisions and even particular runs was wrecked forever. The Ps-4's, along with other SR steam power, entered pools to be assigned as needed. As its mechanical force became more and more interested in diesels, the quality of steam power maintenance began to slip. With pooling of steam power the individual pride of "ownership" disappeared in many quarters. In 1941 it was inexorably clear that the field of service assigned to the Ps-4's would gradually diminish throughout the years to come.

It took a world war to lengthen the life of the obsolescent Pacifics after that date. In the wartime system of allocations and priorities that followed declarations of war on Japan and Germany, a Southern that was definitely committed to complete dieselization was practically denied the tools to achieve it. The big system, deciding to forego orders for new steam power, dug itself in and prepared to rely on its existing locomotives plus some aging Mikes it bought from Erie storage lines in 1944. There were yet more years of glory for the first ladies of the Pacifics, for the unprecedented passenger train-miles called for by troop movements and heavy travel made it imperative that steam be kept working to the limits of its availability.

Some of the runs of Ps-4's in those years were brilliant. The mighty wartime parades of SR night expresses south out of Washington will never be forgotten. A regular train would be swamped with demands for space; No. 1395 might be seen forwarding the first and Pullman section, with a tandem of Nos. 1391 and 1377 following on the block of the sleepers, hard-hammering a swollen head-end and coach section of the same schedule. The pattern would be repeated several times during the night with trains in each direction.

Southern had no task more grim in the long years of war than handling the late President Roosevelt's funeral train up from Warm Springs, Ga., to Washington. From Atlanta north, double-headed Ps-4's powered the 11-car train. Appropriately, among the locomotives employed in this last trip of the man who rode the Southern so often were Nos. 1366 and 1409, first and last of the Ps-4 class.

World War II and dieselization spelled the end of SR's optional equipment policy. Now that the time of engine crews and shop forces was at a premium, it seemed that no one any longer shined up the candlesticks or scrubbed the green jackets. Gradually the extras were stripped from Ps-4's to go into war scrap. Occasionally one of the Pacifics came out of the shop

James G. LaVake.

No. 1384 displaces a diesel at the business end of the northbound Peach Queen in Atlanta. Regal and rebuilt, she concentrates Worthington feedwater heater and air pump under elevated running board, features welded cab shade, multiple-bearing crosshead, big steamboat whistle.

Top, Leonard McLean; bottom, Thomas A. Acree.

Ps-4's 1384 and 1409 doublehead out of Atlanta (top) with local No. 136 for Washington. In a rare old print (bottom), Cincinnati, New Orleans & Texas Pacific No. 6475 goes out of character to help a manifest up Erlanger Hill, Ky., south of Cincinnati. Ps-4 is equipped with smoke duct.

Shelby F. Lowe.

The Queen is dead. Alabama Great Southern Ps-4 No. 6684 is towed to certain scrap at Hayne, S. C., between two 4500-series 2-8-2's. This engine and sister 6685 were the first of the system's heavy Pacifics to be written off the books. Many more are doomed to go as Electro-Motive road passenger diesels swallow up the remaining schedules for which Ps-4's are suitable.

looking well cared for, but by and large the old traditions were forgotten in the rush of more urgent matters.

Mechanically, the engines came by minor modifications in later years. Beginning in 1940 Southern began to equip all of its locomotives with multiple bearing, suspended-guide crossheads in place of their original Alligator type riggings, and by 1943 all of the Ps-4's were so equipped. Most of series 1366-1409 were eventually restyled with high, straight running boards, which allowed for more room around cylinders and running gear when installing such appliances as by-pass valves and improved mechanical lubrication systems. Coal cowls of many Ps-4's were built up, thereby increasing capacity for handling that fuel by many tons.*

No. 1396 came from one shopping with her Elesco feedwater heater "sunk" in the fashion of the unstreamlined NYC J-3a Hudson. No. 1409 was stripped of her original Coffin heater, and a Worthington three-unit model SA heater, so popular with the road in recent years, was installed. In 1950 a few Ps-4's are carrying anti-smoke firebox jets, and at least one has an undergrate air distributor. These were all small refinements, though. It is important to note, as a sidelight on SR's early plans for complete dieselization, that none of these first-line passenger locomotives was ever equipped with such major improvements as roller bearings, disc-centered drivers, cast steel engine beds, boosters or lightweight rodding.

Of recent years one of the most famous of the first ladies has been No. 1380. She was streamlined by Otto Kuhler in 1941 to handle the then all-coach *Tennessean* from Washington to Monroe, Va., delivering the train to or taking it from Norfolk & Western 4-8-4's at that point. Later, diesels took over this Washington Division run and the 1380, still streamlined, serves in the same pool as her sisters.

In 1950, as the Southern moves toward the inevitable conclusion of its dieselization program, the Ps-4's have been reduced to an existence of shabby if proud gentility. They have the plug runs now — a few mail and local schedules on the Washington-Atlanta main, the CNO&TP's accommodation, an occasional AGS extra, and scattered other supporting runs in the Carolinas and Georgia. More of the Pacifics stand by to protect diesel runs; in peak traffic periods they handle second sections of name trains or college vacation specials — all a long way from the steam-opulent days of the 1920's and '30's, from the premium runs and splendidly maintained liveries of their youth.

As late as February 1 of this year there was still a measure of the old elegance to be seen. On that day the clouds of an overcast sky parted at Spencer, N.C., site of the SR's large eastern locomotive shops, and the sun made dazzling a splendid and surprising collection of newly groomed Ps-4's. Nos. 1378 and 1372, fresh from the paint shop and getting applications of aluminum paint from workmen with brushes and buckets, were parked just outside Spencer's 40-stall roundhouse. Out on the ready track Nos. 1394, 1408, 1376 and 1404 appeared tough, immaculate and impatient to be off. Inside the house Pacifics 1401, 1375, 1396, 1398 and 1369 were getting it from Alemite guns and stoker and running gear mechanics. Other engines were awaiting sessions in the long Spencer erecting hall. Even prima donna 1380 was in town, spotted like a monument alongside the landscaped garden in front of the master mechanic's office. The engines looked good. It was as if they were all ready to take fast wheels on the *Crescent* or the *Piedmont Limited.*

Actually, they were being prepared for no such thing. They would go out on Washington-Atlanta locals 135 and 136 or on through mail trains 11 and 12. One might catch the Greensboro-Goldsboro leg of the *Carolina Special.* Others would just stand and wait.

Yes, old age is setting in for the first ladies. Already two AGS Ps-4's, 6684 and 6685, have died to the flame of the cutting torch at Hayne, S. C., and more will follow. Certainly new diesels will eat heavily into the wretchedly small assignments the green steamers still have. A TRAINS editor's wistful remark of last November seems to sum up the status of the Ps-4's in 1950. He said simply, "One day they won't come back."

The 1366's, the 6471's and the 6684's will all die; but friends of the Southern Railway, railroaders and plain folk alike, will quietly and perhaps unconsciously hate it. And a new generation of southern youth will grow up to admire the sleek, steady EMD diesels that now ply the system that serves the South.

Ps-4 specifications

for No. 1396 as constructed by Alco's Richmond Works in 1926 for Crescent Limited service:

Cylinders, diameter and stroke, inches	27x28
Tractive effort, pounds	47,500
Cylinder horsepower	2,624
Drivers, inches	73
Weight on drivers, pounds	182,000
Weight on front truck, pounds	61,000
Weight on trailing truck, pounds	61,000
Total weight of engine, pounds	304,000
Driving wheel base	13'-0"
Total engine wheel base	36'-1"
Boiler pressure, pounds	200
Grate area, square feet	70½
Tender capacity: gallons of water	14,000
tons of fuel	16

*The six-wheel-truck, 14,000-gallon tanks of CNO&TP Ps-4's 6476-6479 and 6481 were "traded off" about 1942 to CNO&TP light U.S.R.A. 4-8-2's 6495-6499, the Pacifics getting the 10,000-gallon tenders that originally equipped the Mountains. CNO&TP Ps-4's 6471-6475 were outfitted with Elesco bundle-type feedwater heaters about 1935 to replace their original Worthington heaters.

New York Central's 5344 posed for the camera in July, 1939, the same month in which she was streamlined for the second time. At this time the 4-6-4 was assigned to the second section of the Mercury. Collinwood Shops (Cleveland) completely restyled the engine in 1939 but the tank is apparently the same one coupled to the locomotive when she carried Commodore Vanderbilt's name and starred as the first streamlined steam power.

Most famous Hudson

No. 5344 has been rebuilt four times and streamlined twice in 18 years

BY DAVID P. MORGAN

THE citation of a single Hudson as *the* most famous 4-6-4 is a task that commends itself to intensive research. On the Atchison, Topeka & Santa Fe, Hudsons with seven-foot drivers have been credited with speeds in excess of 120 miles an hour, while the Illinois Central's one example of the type was at one time assigned to the world's fastest freight train. Otto Kuhler and Henry Dreyfuss top the artistic talent which, in streamlining *new* power, has managed to shroud more 4-6-4's than any other standard wheel arrangement in steam. All three major steam power builders — Alco, Baldwin and Lima — have tried their hands at Hudson construction, as have company shops ranging from Decatur on the Wabash to Springfield on the Frisco. The 4-6-4 is also remembered as the type that translated the high-horsepower sermon of Lima's A-1 Berkshire into the realm of high-speed passenger service. Indeed, for one golden hour the Hudson was a source of dismay for diesel advocates as it held down the business end of such strenuous and money-making hauls as the Milwaukee Road's *Hiawathas* and the Santa Fe's extra-fare *Chief*.

The selection of the most famous Hudson is rendered no less complex by the score of patterns to which 4-6-4's were engineered. Baltimore & Ohio's Mount Clare-built *Lord Baltimore*, for instance, was much lighter than many Pacifics, including Pennsy's K-4. Conversely, Chesapeake & Ohio's poppet valve L-2, world's heaviest 4-6-4, is a larger engine on the basis of locomotive weight than the Richmond, Fredericksburg & Potomac's Northerns. Other Hudsons have been

No. 5344 as she looked when Alco delivered the 4-6-4 to the NYC in 1931. It was this identical engine that the Lionel Corporation duplicated in thousands of its $75 prewar scale models in O gauge. NYC block lettering and numbers replaced style used here.

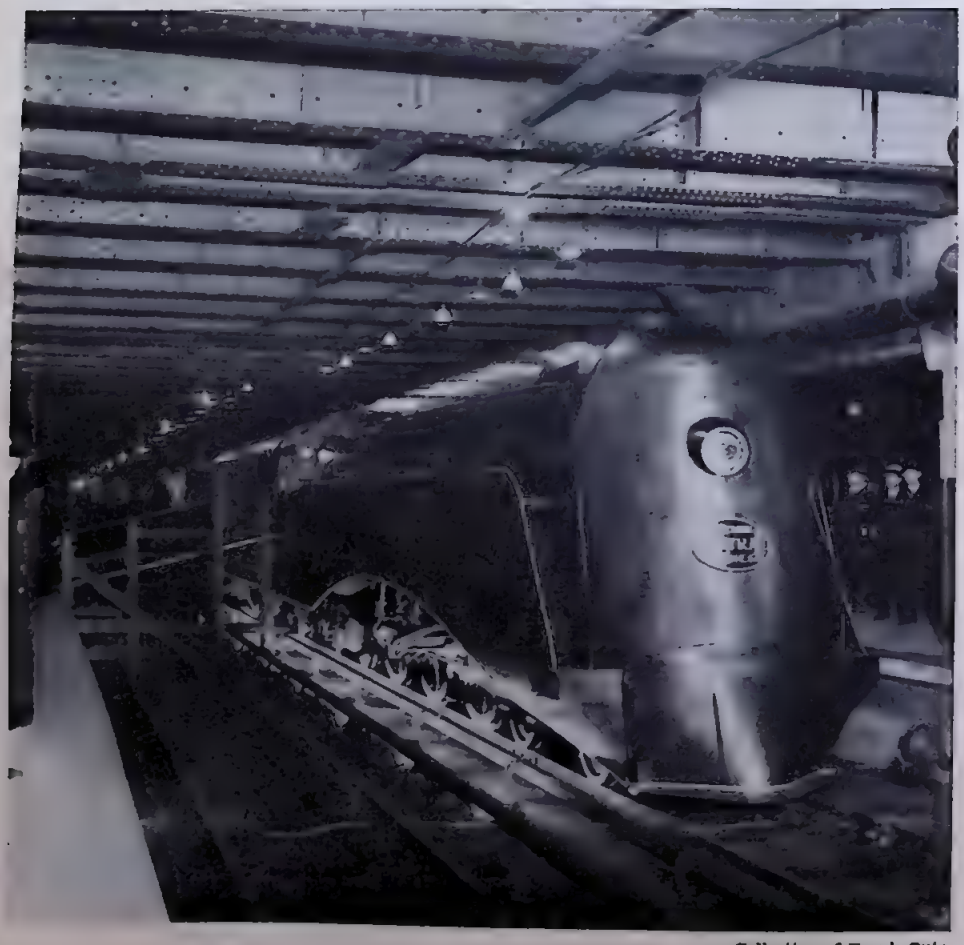
derived from engines orginally built as Pacifics, 2-8-2's and a Berkshire. The Wabash's five P-1's are typical: they were once three-cylinder Mikes which lent their boilers to the Decatur Shop creation of semi-streamlined fast passenger motive power.

It remains singularly appropriate, however, that the most famous single Hudson is numbered in the roster of the system which introduced the wheel arrangement to the United States in 1927 and christened it after the river its main line parallels. Currently this renowned engine is in a pool of steam passenger power on Lines West of the New York Central, working out of Collinwood, Ohio. Today No. 5344 is apt to be wearing a coat of grime, looking more or less like hundreds of other NYC Hudsons from Buffalo to Beech Grove. In a sense, that was 5344's status in November, 1931, when she moved out of American Locomotive's Schenectady Works as a new class J-1e unit. A study of her builder portrait above will show that the phrase "handsome Hudson" was entirely justified, but she was simply one of many duplicate machines funneled into the Central's mainline service from Harmon, N. Y., west.

All that was changed in 1934 when 5344 was selected for a face-lifting in NYC's own West Albany, N. Y., shops, emerging in December as the *Commodore Vanderbilt*, the nation's first streamlined steam locomotive in the *Zephyr* fever of styling. Ably encouraged by the Central, the press declared that this was steam's comeback against the internal combustion engine. It was a bright day for a big road otherwise concerned with a dreary depression's effect upon traffic and earnings. Later, in August 1935, West Albany lifted No. 5344's bathtub hood long enough to improve her operating efficiency with Scullin double-disc drivers and Timkenized lightweight rodding and crossheads.

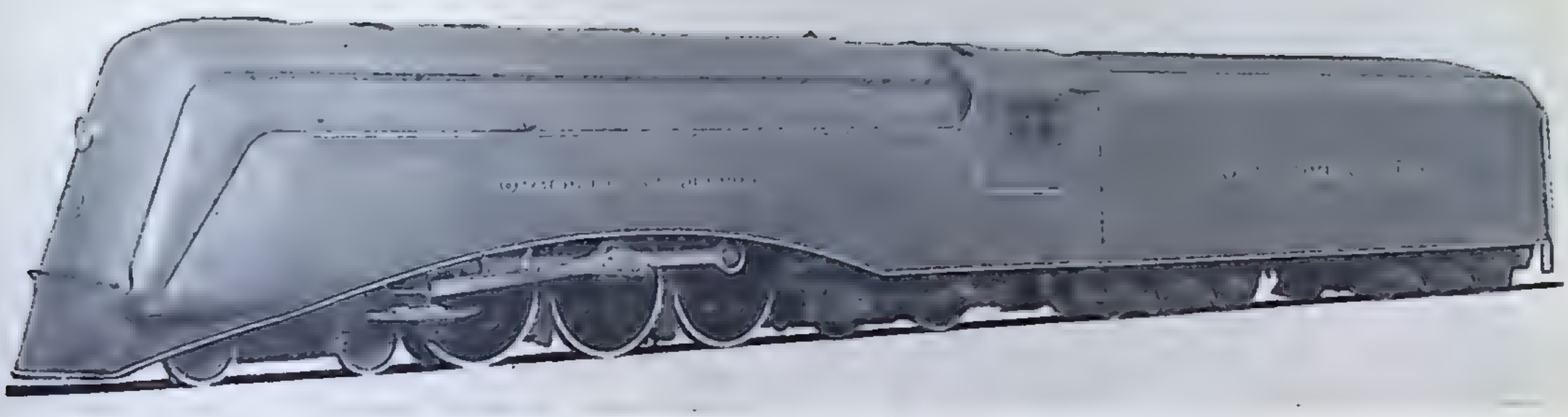
The *Commodore* never looked as spectacular after 1938, the year in which Alco delivered 10 J-3a Hudsons to the Central, especially styled by Henry Dreyfuss for the new streamlined *Twentieth Century Limited*. Comparatively speaking, No. 5344 suggested the definition of cumbersome. NYC apparently felt so too, for it sent the engine to Collinwood Shops and there re-streamlined her in the modern Dreyfuss design. That was in July, 1939.

For the next six years No. 5344 (the name *Commodore Vanderbilt* van-



Collection of Frank Quin.

As the Commodore Vanderbilt, No. 5344 invaded the electrified caverns of Grand Central to display her streamlined shroud. Wooden walkway over track to left permitted police-regulated crowd of sightseers to view 5344's cab.



Almost a year after she was streamlined, No. 5344 returned to West Albany Shops to be modernized with Scullin double-disc drivers and Timkenized lightweight rodding. In this publicity photo drivers and trucks on blind side of engine have been silhouetted out.

ished with the original shroud) continued to share fast and heavy assignments with the NYC's most modern 4-6-4's, taking her turn on most of the system's celebrated schedules. One fateful afternoon in the early summer of 1945 she was accelerating the *Paul Revere* through East Chicago at about 80 miles an hour when a sand truck driver incorrectly estimated the engine's speed at a grade crossing. Hudson 5344 held the iron in the best tradition, but the debris of the truck put a hole in one side of her bullet nose and dumped pounds of sand along her running boards. Another 4-6-4 took the *Paul Revere* on to Boston that afternoon.

Not long after that, in October, 5344 had her streamlining removed and a huge PT 4-10-0 tank substituted in return. Her new tender, incidentally, had been built by Lima.

Now, a little more than 18 momentous years since Alco riveted its data plate to No. 5344's smokebox, the big girl looks much as she did in 1931. The PT tank is different, as are the Scullin drivers and the enlarged side rod roller bearing hubs. But the famous front end is intact with Commonwealth drop-coupler pilot, covered air pumps on the pilot, and a proportioned smokebox door. From bell to booster No. 5344 is a Hudson — and the most famous of them all.

The most famous Hudson as she is today: No. 5344 pauses for a portrait on an icy day at Ashtabula, O. Final de-streamlining came after the Hudson hit a sand truck in the summer of 1945, an accident which punched a hole in the bullet nose of the 4-6-4. Since then NYC has removed the streamlining from all of its newer J-3a Hudsons as an aid to more efficient maintenance; diesels haul most NYC streamliners.

Missouri Pacific's ultimate in concentrated steam power and the road's only poppet-valve engine: Pacific 6001. Robert J. Foster.

Madam Queen

MISSOURI PACIFIC LINES

THE story of the experimental Missouri Pacific 4-6-2 illustrated on these pages takes the locomotive student back to 1922 and a certain New York Central Mohawk. In that year American Locomotive Company engineers decided to dust off the old (since 1846) three-cylinder principle and make a practical demonstration of the idea in the modern railroad world. In theory such an engine should exert a greater starting tractive effort along with less dynamic augment and better fuel combustion. Simple arithmetic showed that that amounted to more locomotive in the same length and was worth a test.

The NYC 4-8-2 which served as a guinea pig was extensively overhauled and rebuilt with three cylinders. Road tests of the Mohawk were apparently not enough to convince NYC, but Al-

American Locomotive's builder photo of Missouri Pacific's No. 6000 indicates a strong reflection of U.S.R.A. traits in her design. As built and delivered to the road in January, 1925, the experimental was basically a sister to the MP's later 1151-series 4-6-2's for the I-GN and StLB&M.

co was encouraged to outshop a custom Mountain for the Lehigh Valley along the same lines. That 4-8-2, No. 5000, did the trick, and Alco got busy broadcasting its merits and building more three-cylinder locomotives. Two of them were sold to the Missouri Pacific in 1925 — a Mikado that made headlines on PRR's Altoona test plant, and the Pacific shown here.

No. 6000's initial performance on the Mopac was good. *Railway Age* reported to the industry in May, 1925: "The Pacific type locomotive, No. 6000, after having been broken in in freight service, was placed in passenger service and has made a number of runs between Kansas City, Mo., and St. Louis, and between Hoxie, Ark., and St. Louis. Between the latter points a particularly difficult 2 per cent grade four miles long is encountered. Locomotive No. 6000, handling train No. 4, Hoxie to St. Louis, with 11 cars, was able to negotiate this grade without trouble and reached the top at a speed of 23 miles per hour."

The off-beat exhaust of the *Six Million* (as she was later known) topping that 2 per cent must have been music to the MP engineering men aboard, but the melody soon became discordant. Unlike the British, American railroaders were not used to maintaining a locomotive with a third of its running gear housed within her frame. The 6000 spent a good many of her first six years in the shop; from 1931 through 1937 she was variously in and out of service and stored. The three-cylinder idea had been trampled underfoot in the rush for Lima's 2-8-4 "Super Power" innovation and the high-speed articulateds, Hudsons, Texas types, and 4-8-4's that followed. Mopac's 6000 was an unwanted child.

North Little Rock Shops and the Franklin Railway Supply people took a hand in No. 6000's destiny in November, 1942. Franklin was and is selling a new version of poppet valves that promise 16 per cent more horsepower at 40 miles per hour, almost 30 per cent more at 88. Mopac thought the plan had possibilities and selected the three-cylinder Pacific as a convenient test lab since it was obvious that the 6000 was a misfit for anything else on the railroad, excepting scrap.

Little Rock did a good job. In place of three cylinders came just two, actuated by Franklin Type A poppets; oil replaced coal as fuel. In addition the Mopac put the engine on roller bearings, modernized her with such equipment as an Elesco exhaust-steam injector and new rods, and gave her the number 6001 — otherwise known as *Madam Queen*.

The *Queen* again fell down during the first three months of her rebuilt life — but after that the 6001 turned out to be the equal of an MP Mountain type. Usually where a 4-6-2 of the 6001's weight was allowed 10 cars, a 4-8-2 could handle 14. The *Queen* not only rearranged the tonnage-rating chart for her wheel arrangement but also ran off 102,000 miles in a 12-month period over the road's Arkansas and Memphis divisions. Throughout the duration of the war, when the Mopac shouldered its load with steam, the 6001 was reckoned to be a mighty valuable engine to have around in the Ozarks.

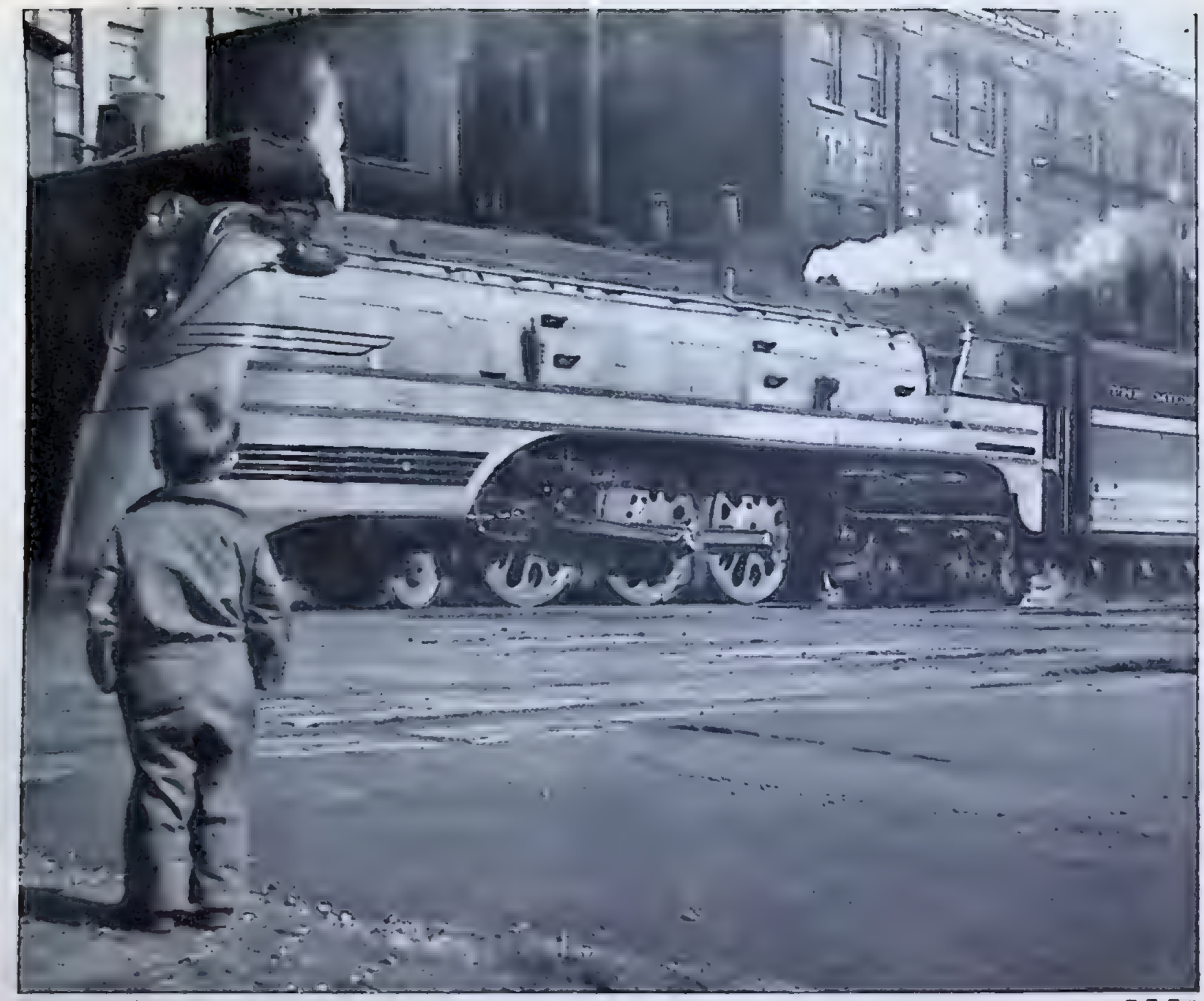
Except for Electro-Motive, the *Queen* might well have forecast ranks of poppet-valve Northerns and Mountains on the Mopac. But the diesels came. Today No. 6001 is considered to be fortunate in handling Memphis locals, since the MP has scrapped newer and heavier 4-8-4's.

Robert J. Foster.

The obvious contrast between the three-cylinder 6000↑ and the poppet-valve 6001 she became↓ is wrapped up in cylinders and valve motion, of course. But other changes in the rebuilt Pacific invite study — including the application of boiler jacketing over the smokebox, top-feed injectors, illuminated engine number boards behind stack, the shift from soft coal to oil as locomotive fuel, Elesco exhaust-steam injector, and improved suspension-type crosshead guides.

Robert J. Foster.

Although No. 6001 is still in active passenger service on the Mopac, she works out on Little Rock-Memphis locals rather than Sunshine Special sections. Her appearance of ultra-compact power here is accentuated by a center pair of disc drivers and grouped cross-compound air pumps on side.



Milwaukee Road's No. 105, an F-7 Hudson. C. P. Fox.

Ask the little chap

ASK *the Milwaukee Road* and they'll inform you that it's No. 105, a class F-7 streamlined Hudson which they bought in 1938 to haul the *Hiawatha*. They'll call attention to its distinguished styling and distinctive orange, gray and maroon coloring — and they'll add that the *Hi* is dieselized now and has a sky-top observation-parlor car designed by Brooks Stevens.

Question the American Locomotive Company and they'll agree that it's No. 105, the last engine in a series of six delivered to the Chicago, Milwaukee, St. Paul & Pacific in 1938. Alco will tell of its styling by Otto Kuhler, of its 84-inch drivers and 50,300 pounds of tractive effort, and of its total weight of 415,000 pounds. They might also note that their Schenectady plant built nine rather similar machines for the Chicago & North Western in the same year— and they'll be sure to remark that American Locomotive built the world's first 4-6-4 for the New York Central in 1927.

Talk to the railroad enthusiast and he will answer in terms of disc drivers and a 300-pound boiler pressure. He'll concede that the F-7 is inclined to be a slippery engine and then he might speculate on what effect a booster would have. And he'll ask if you've ever observed an F-7 bringing the 18-car *Columbian* in from Chicago on a winter evening when the snow is flying thick. He might even mention a 68½-minute Milwaukee-Windy City run behind No. 101, a sister.

But then talk to the little chap in coveralls at the 13th Street crossing in Milwaukee. He'll tell you the truth: It's the most wonderful thing in the world and it has a voice of thunder. It is *speed*; it is *strength*. Dad says it comes from Chicago and goes way up north. The little fellow tells of a great ambition, too: he would like to be up in 105's cab — and perhaps someday he will be there.

Only the boy is able to give you a full answer, for the impact of 105's steam-and-steel glory has been registered fully on his mind alone. He needs no blueprint nor motive power roster nor timetable; he stands quite still and merely looks at a proud and gallant monster. The 4-6-4 has conquered his free and open imagination and tonight he'll dream of holding its throttle. — D. P. M.

No. 5314, class P-7c, on the *National Limited* at Roselle, N. J. By H. F. Harvey.

The Presidents — B&O's super Pacifics

Diesels and years of service have bothered them only slightly. They still pull some crack trains

BY RALPH G. DUNN

IN the 1920's the Baltimore & Ohio was using light Pacifics to handle its fleet of fast Washington-Jersey City passenger trains. But as the trains got longer and the cars heavier the B&O recognized the need for larger, high-speed engines. It turned to the Baldwin Locomotive Works, and in 1927 Baldwin outshopped 20 Pacifics for the B&O that have become well known as one of the most outstanding examples of the Pacific type.

The 20 4-6-2's were classified as

Builder's photo of the President Garfield, No. 5318. It was delivered in 1927 by Baldwin in a coat of olive green paint with red and gold striping. It has been rebuilt to class P-7c.

The thrifty compound

Steam doesn't give up all its energy the first time it's used in a locomotive, Sam Vauclain argued. Why not use it again? The compound locomotive, though recognized as about gone, hasn't given up either

BY S. R. WOOD
AND DAVID P. MORGAN

IN the dusk of his long and distinguished life, Baldwin Locomotive's Samuel Vauclain sketched for a group of mechanical engineers a superb steam locomotive. The white-maned chief of Eddystone suggested a high-pressure, three-cylinder Northern with 80-inch drivers. A compound 4-8-4, of course.

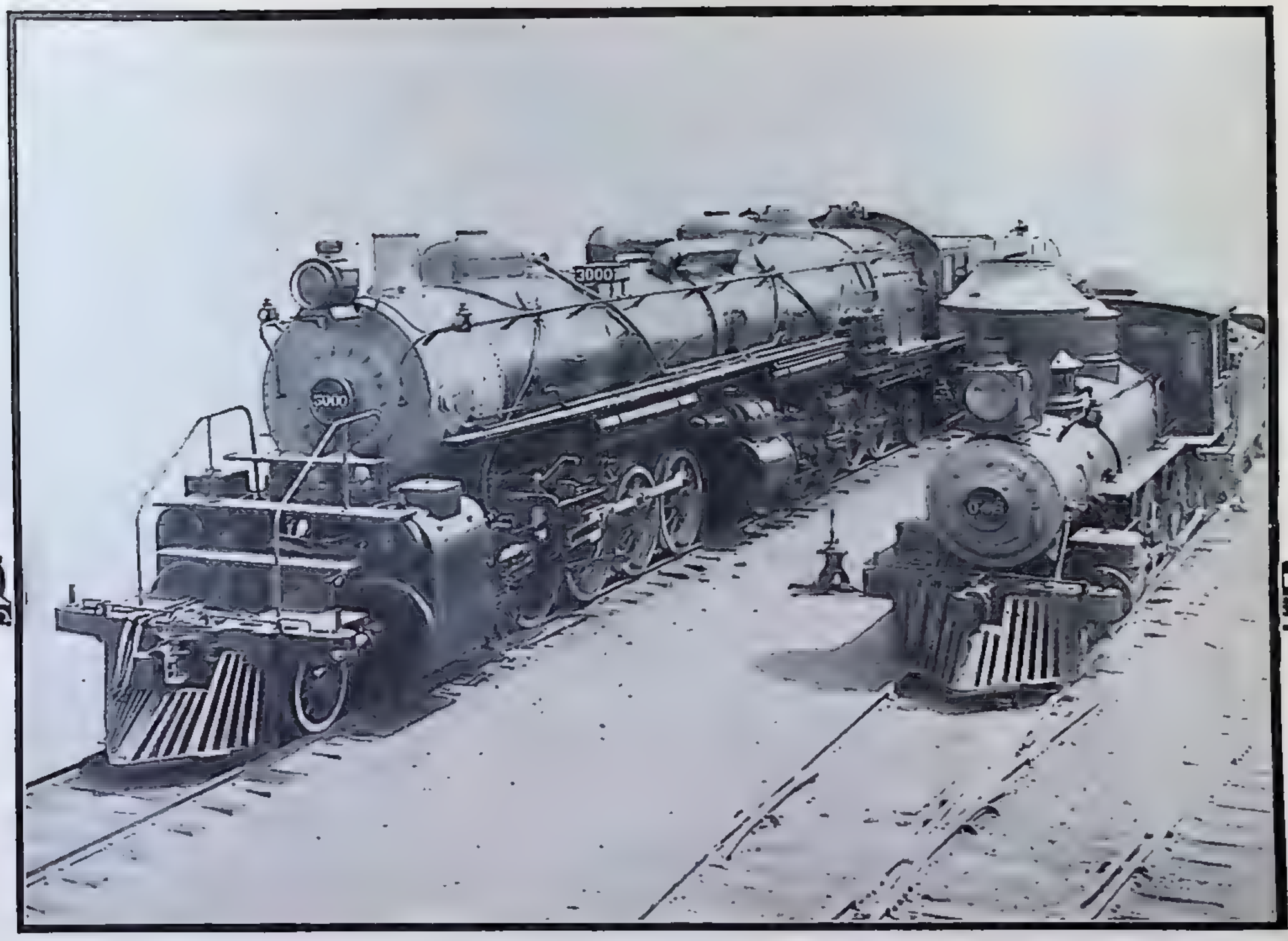
Sam Vauclain frankly and eagerly accepted the obvious. He was aware that compounding was and is a fundamentally sound idea, and that an engine using steam twice will haul more tonnage on less coal. Fifty years ago that belief bred both allies and enemies, just as the diesel split railroaders into two camps only a decade back. In 1900 a master mechanic voted either "simple" or "compound," and the Atlantic City mechanical conventions echoed to the debates, for and against. Pennsylvania Railroad men, who have always considered their Altoona Shops the Taj Mahal of locomotive engineering, turned thumbs down. But Southern Pacific brass stood up for the compound, and there was no limit to the enthusiasm of the Santa Fe crowd. The letters department of *Railway Age* bulged with correspondence proving conclusively that double-expansion engines were the best innovations since the American Standard — and also a fatheaded theory possibly contrived by the builders to inflate the locomotive market.

Few of the walrus-mustached, derby-hatted boys who stood up for or against the compound locomotive in its years of big debate could have dated its birth, though. Even today historians question whether or not two English engines of 1851, supposedly compound, really used steam twice. And in 1867 there was far too much hip, hip, hooray over the completion of the Pacific Railroad for many to notice that the Erie had rebuilt an aged Hinkley & Drury 4-4-0 into a tandem compound. This engine, possibly the world's first compound, failed to prove much anyway — except that she couldn't supply steam, much less work with it more economically.

That left the way clear for two imaginative Continentals. First, "Frenchman" (of Swiss birth) Anatole Mallet drew up plans for both a two-cylinder compound and the articulated engine that made his name a household word in American roundhouses and backshops. Second, Alfred G. de Glehn — of tricolor ancestry — built a high-speed, four-cylinder balanced compound for the Northern Railway of France. De Glehn's engines excited so much attention that both the Great Western Railway (England) and the Pennsylvania imported them for tests.

Baldwin Locomotive Works' No. 60,000 was the three-cylinder compound demonstrator that toured the continent but located no customers. Its 4-10-2 wheel arrangement is employed by only two roads, Union Pacific and Southern Pacific. The big Baldwin performed well on its junket, although it was stored for a while in California by a zealous I.C.C. inspector who was dubious about its 350-pound boiler pressure. It is now in Franklin Museum, Philadelphia, where now and then it is rolled a few feet by an electric motor for the benefit of the visitors.

OVER here, though, we were prone to shy away from the complex; and the first compound that sold well was the simplest one of all: the two-cylinder or cross-compound. It was a slow, lopsided, off-beat-exhausting creature. A high-pressure cylinder was fitted to the left side of the engine. The boiler steam went to it first, was used, then exhausted across to a larger, low-pressure cylinder on the right. The "l.p." cylinder had approximately 2.5 times the volume of its companion, a ratio found in practice to develop equal thrust from both pistons.



Clarence J. Root collection.

Santa Fe 2-10-10-2 No. 3000 poses alongside American Standard No. 048. The articulated was the first of 10 such engines assembled at Topeka Shops in 1911. A reconstructed tandem compound 2-10-2 was used as the high-pressure unit; the remainder of the engine was new. After only six years of service 3000-3009 were cut apart and rebuilt into 20 simple 2-10-2's numbered 3010-3019 and 3020-3029.

A cross-compound was "worked simple" when starting — that is, fresh boiler steam was used in both cylinders because tractive effort was then up to 20 per cent greater. Once under way with its load, the engine became a true compound. At first this switch was automatic, operated by a large pipe inside the smokebox known as the receiver. As the engine started, steam from the "h.p." cylinder was exhausted into this receiver pipe until a pressure of 100 pounds per square inch had been reached. At this point it kicked over an intercepting valve which shut off boiler steam to the "l.p." cylinder and introduced once-used steam from the receiver instead. After that the engine was all-compound. Once it stopped, a spring cut the intercepting valve back over to a "simple" position.

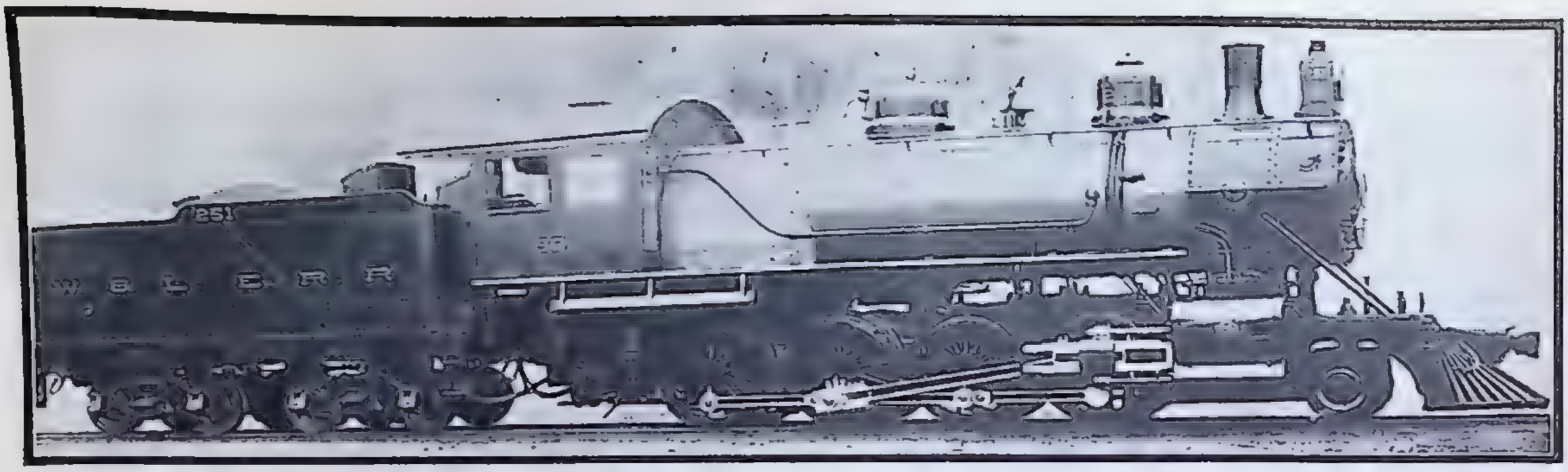
This neat arrangement was too automatic in practice, and Southern Pacific, for one, thought the engineer should have more to say about whether his engine was running simple or compound. So Espee designed a system whereby the engine worked simple as long as the reverse lever was "down in the corner"; as soon as it was notched up, the engine shifted into compound operation. Then Superintendent Pitkin of Schenectady (a big builder of cross-compounds) went one better in 1896 by designing a three-way valve mounted on the backhead — a valve that permitted an engineer to work his engine compound or simple at will. This had the effect of a booster when the engine stumbled on a heavy grade; it also permitted smoother starts, thereby helping to heal the cross-compound's bad reputation as a rough-starting locomotive.

Evolution overtook the cross-compound. She was capable of saving 15 to 20 per cent in fuel over a simple engine of similar size — but lack of balance, low speeds, and loginess stacked up against her.

Into the compound battle strode Samuel Vauclain — the young man who had risen rapidly from an apprentice at Altoona to works manager at Baldwin by long hours and sheer ability. Vauclain took out a patent in 1889 on a four-cylinder compound and in October of that year Baldwin built its first compound, a 4-4-0 to Vauclain's design for the Baltimore & Ohio. It was a brilliant, instant success and won Baldwin unprecedented fame both here and overseas. During 1895-1896 Russia bought 138 such machines alone and by 1904 — when the design faded — the Philadelphia works had delivered over 2000 such locomotives.

The Vauclain wore two cylinders on each side, located outside the frames. The top cylinder on each side was high pressure, with a low-pressure cylinder directly beneath it; this two-cylinder assembly was cast in one piece with a valve and half saddle. A 3-to-1 ratio was maintained between the "l.p." and "h.p." cylinders. A variation, sometimes employed on freight engines because of clearance considerations, was to place the bigger "l.p." cylinder above the "h.p." unit. Then the engine was known as an "upside-down compound."

Both cylinders drove on a common crosshead. Both were also given steam admission by a common valve. Exhaust steam from one end of the "h.p." cylinder was shuttled to the opposite end of the "l.p." cylinder for secondary usage. Vauclain engines came equipped with a valve that permitted the engineer to work them simple at will; this was actually a by-pass valve that



S. R. Wood collection.

Wheeling & Lake Erie's 2-8-0 No. 251 was an "upside-down compound"; that is, her larger low-pressure cylinders were mounted above her smaller high-pressure cylinders. Both drove a common crosshead. No. 251 was a modification of Samuel Vauclain's compound principle. She was outshopped by Baldwin in 1903, and was typical of over 2000 locomotives so designed.

admitted live steam to both ends of the "h.p." cylinder at once, thereby sending it from one end straight into the "l.p." cylinder and rendering the whole engine simple.

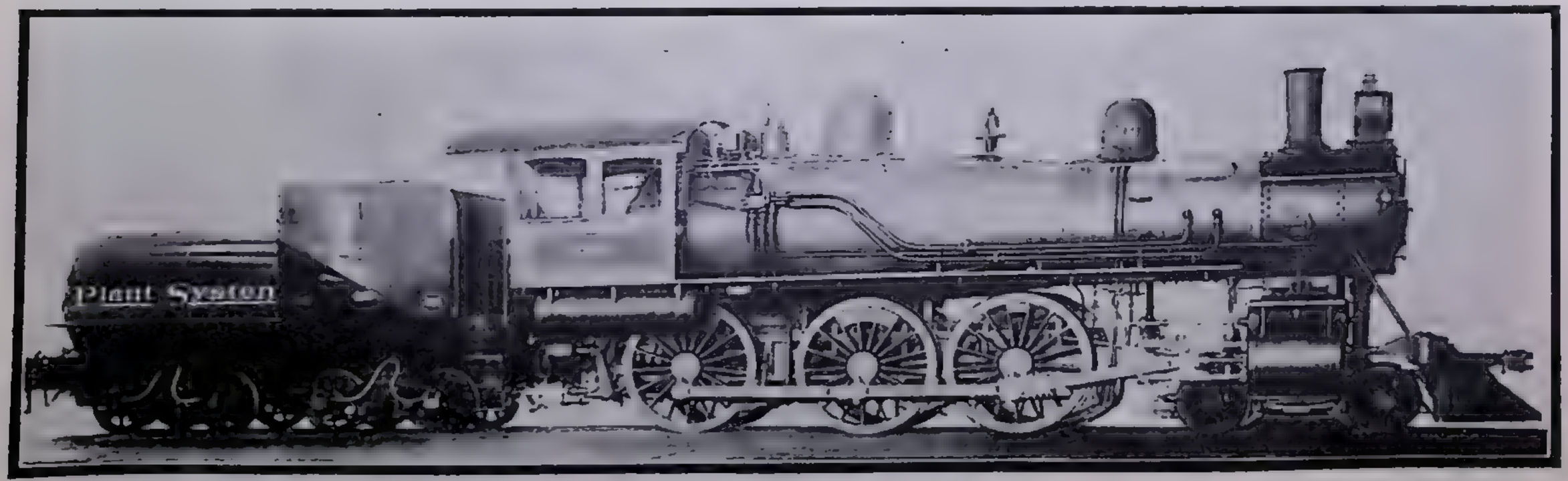
The most famous Vauclain compound was a Philadelphia & Reading Camelback with drivers so high (84½ inches) that they rose up through her running boards into fenders, British style. Built for the Atlantic City Railroad (later P&R), 4-4-2 No. 1027 and her sisters covered the 55½ miles between Camden and the seaside resort in a scheduled 52 minutes — and often cut that time to 48 minutes, or an overall average of 69 miles per hour. When the ferries from Philadelphia were late, No. 1027 would occasionally hit 115 miles per hour across the Jersey meadows and marshes. She was a thoroughbred performer, and as fine an engine as Baldwin ever outshopped.

Baldwin's 20,000th engine, built in 1902, was more than a big-boilered 4-6-0. She incorporated Vauclain's revised compounding theory, known to the trade as a balanced four-cylinder layout. The large low-pressure cylinders were hung outside the frames with the high-pressure cylinders cast into the saddle and located between the frames. One valve on each side controlled admission of steam to both "h.p." and "l.p." cylinders so that each of the crossheads concerned worked in opposite directions. All four cylinders drove on the same pair of drivers, with the crank on the axle and the crank pin on the driver for a pair of "h.p." and "l.p." cylinders set at an angle of 180 degrees. The two crank axles were set at an angle of 90 degrees. As a net result, the combined action by cylinders on one side of the engine was balanced off by the opposing action on the other side — with no unbalanced rotating weight to lift the drivers off the rails.

It did not take the newly formed American Locomotive Company long to develop a rival, what with Vauclain's employer breathing down its neck. Francis J. Cole (who later designed Alco's monumental Pacific, the 50,000) retired to his drawing board and came back with the blueprints for New York Central & Hudson River No. 3000, an Atlantic produced in 1904. Her low-pressure, outside cylinders drove on the rear driving axle. The high-pressure cylinders were blandly shoved right out on the pilot — over 4½ feet ahead of the low-pressure pair. These cylinders were cranked on the front driving axle, between the frames, of course. The Cole engine was equipped with four piston valves and, like the Vauclain, all moving parts were perfectly balanced to eliminate track pounding, yet develop maximum tractive effort. The original NYC&HR 3000 had Stephenson valve gear but later versions were designed with Walschaerts monkey motion so as to permit stronger cross-bracing of the frames.

Concurrent with the original Vauclain compounds, a new freight locomotive was clanking onto the railroad scene — a big, clumsy, amazingly powerful engine known to the trade as a tandem compound. It was the latter-day reformation of the Erie 4-4-0 that had started compounding in the first place. As reintroduced by Brooks in 1892 on Great Northern 2-8-0's, the system involved a high-pressure cylinder mounted ahead of a low-pressure one on each side. Both

Plant System No. 119 was the first Vauclain balanced compound and Baldwin's 20,000th locomotive. Plant System became part of ACL.



S. R. Wood collection.

America's first Mallet, Baltimore & Ohio 0-6-6-0 No. 2400, rolls past the reviewing stand at B&O's famous Fair of the Iron Horse, held near Baltimore in 1927 to celebrate the road's centennial. No. 2400 was used for years as a Sand Patch helper, was scrapped shortly after the fair.

cylinders drove on a common piston rod and both had a common head between them. Tandems matched the efficiency of other compounds but also tended to cut maintenance costs because all cylinders were externally mounted.

It is an oddity that Brooks' chief design engineer John Player was responsible for that plant's tandems while another and unrelated John Player was destined to design more tandems for the Santa Fe a few years later. AT&SF's Player built his own idea of a tandem in the company's Topeka Shops; it involved two separate cylinders on each side, with just a glimpse of oiled piston rod showing between them. Topeka built a 4-6-0 express engine and several 2-8-0's to this design. Then Baldwin outshopped the world's largest locomotives for the Santa Fe — tandems every one. First there came two large Schenectady 2-10-0's, followed by a slightly bigger Baldwin of the same wheel arrangement. These monsters spawned the idea of a 2-10-2, the Santa Fe type. And between 1903 and 1907 Baldwin built 160 such freighters for the Atchison, all of them tandem.

On the heels of the 2-10-2 came an even greater freight locomotive; and it, too, was compound. It was the Mallet, given birth in the United States in 1904 as an Alco-built Baltimore & Ohio 0-6-6-0. Its great forte was not only power, but *flexible* power. It was two engines taking steam from one boiler, and it achieved quick and lasting success. While its basic principle of articulation ideally fitted the requirements of certain western logging outfits, it also found employment as a helper on the Delaware & Hudson, as a Camelback pusher on the Erie, and as an 0-8-8-0 hump engine on the New York Central. The Mallet's true home was in the mountains, though, and there it shoved aside existing Mikes and 2-8-0's — and started tonnage like no engine ever had before.

Two of the strangest Mallets were passenger engines, 4-4-6-2's built by Baldwin in 1909 for the experimenting Santa Fe. These engines had jointed or "accordion" boilers (built on Sam Vauclain's patents), and frequently scared desert jack rabbits with a breathless 50-to-55-mile-an-hour pace, even though their 73-inch drivers had been designed for a 30-mile-per-hour maximum.

Mallets grew in size from 0-6-6-0's to 2-6-6-2's to 2-8-8-2's — and finally blossomed into the Erie and Virginian triplexes. Of these engines, Erie's 5014 *Matt Shay*, a 2-8-8-8-2, was novel in that all of her six cylinders had the identical bore and stroke, 36 x 32 inches. The middle cylinders took steam from the boiler, one of them exhausting to the cylinders in front, the other sending steam back to the cylinders that drove the drivers under the tank.

In 1914 Baldwin took a deep breath and prepared to build for Santa Fe (which had already rebuilt several tandems into 2-10-10-2 Mallets at Topeka) a quadruplex. A Baldwin man named George R. Henderson drew up the plans for the 2-8-8-8-8-2: a compound, accordion-boilered, cab-in-fronter. [See "What Might Have Been," August 1951 TRAINS.] It was a fantastic, wonderful expression of a nationwide obsession with the common railroad denominator of tractive

Fred Jukes, from S. R. Wood.

Santa Fe tandem compound 2-10-2 No. 911, an old mountain battler, stands at Raton, N. Mex., in 1908. Her 19" x 32" high-pressure cylinders are directly ahead of the 32" x 32" low-pressure cylinders on each side. Santa Fe's Albuquerque Shops rebuilt No. 911 into a simple 2-10-2 in 1917. All told, Santa Fe owned 160 compound 2-10-2's and 796 compounds of other wheel arrangements.

S. R. Wood collection.

Soo Line cross-compound 2-8-0 No. 429 carried her big low-pressure cylinder on her right side like a cumbersome valise. When working compound, this type of locomotive had only half as many exhausts as a simple engine; often it sounded like a simple engine "working on one side."

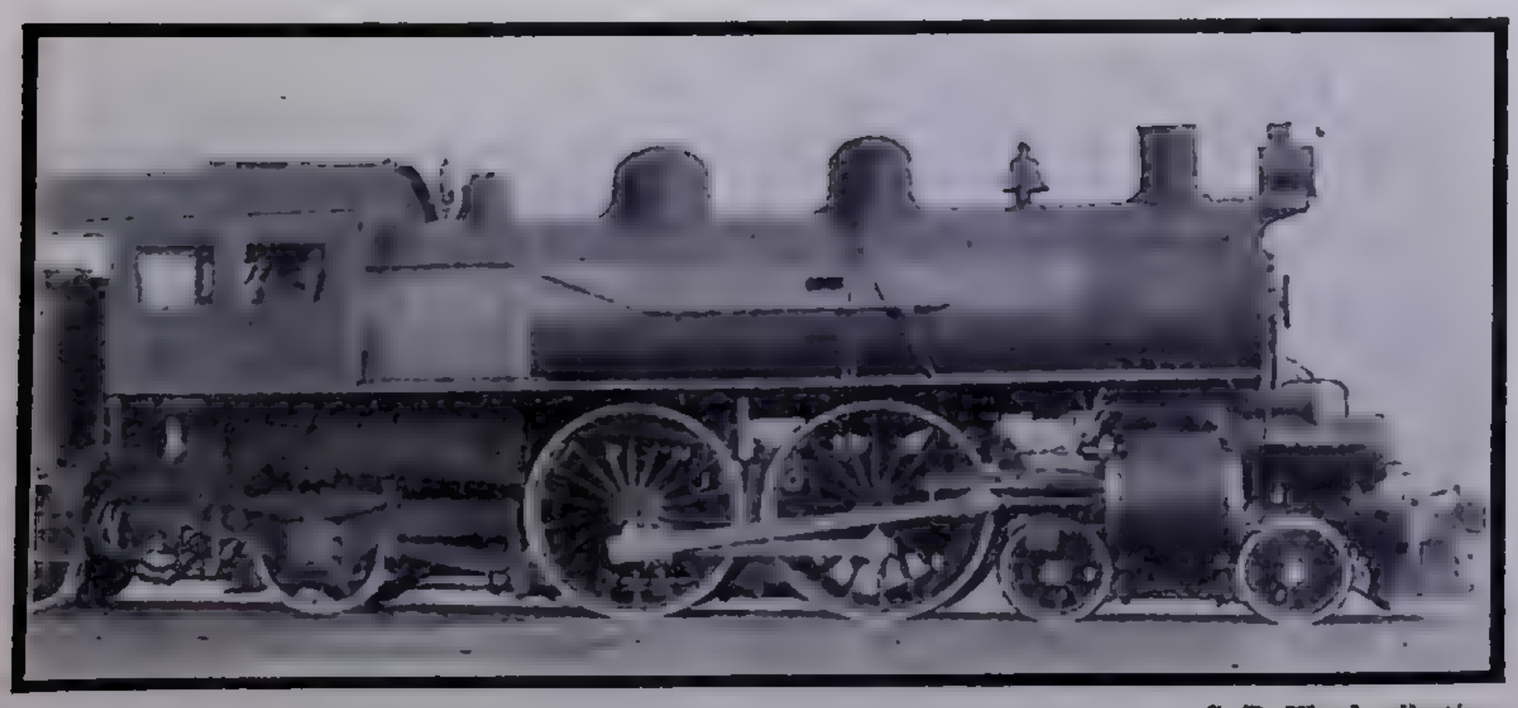
effort. Speed was no consideration; the idea was to see just how many cars could be moved in one train. But it will never be known how many drawbars this 32-drivered compound could have snapped, for World War I indefinitely postponed the project.

Except for the Mallet, which was popular enough to merit two U.S.R.A. designs, the compound was a dead number when doughboys sailed for France. The bullet that slayed it was a tube-infested gadget mounted at the back of the smokebox and called a superheater. At one stroke it gave simple engines compound economies without compound maintenance costs. Better yet, superheaters could easily be fitted to existing engines. Baldwin delivered four-cylinder compound Pacifics to Santa Fe as late as 1914—but that was the end. The ranks of Vauclains and Coles and tandems were either scrapped or rebuilt into superheated simples. Eventually even the Mallet lost ground to a faster engine known as the simple articulated.

A handful of experimental locomotives tried to break down the wall of railroad opinion. Alco constructed very high-pressure, watertube-boilered 2-8-0 and 4-8-0 drag engines for the Delaware & Hudson; but these ponderous machines could not combat the proven advantages of Lima's "Super-Power" Berkshires and the 2-10-4's.

Baldwin, under supervision of the same Sam Vauclain who designed its first compound in 1889, took the bull by the horns. From the erection shop of Eddystone came the plant's 60,000th engine—a compound 4-10-2 with a watertube firebox. Steam, at 350 pounds pressure was fed to a center 27" x 32" cylinder, then exhausted and worked compound in two outside cylinders of the same dimensions. Her tractive effort (minus a booster) was a husky 82,500 pounds.

No. 60,000 was sent on a national demonstration tour, and she licked the pants off any other nonarticulated engine she met between Pennsylvania and California, including other Baldwins. She did that job on consistently lower fuel and water costs, too. But the railroads fought shy of the experiment; they were skeptical of her compounding, her three-cylinder drive and her watertube firebox. "A great engine, yes, but not quite what we had in mind." No. 60,000 rolled back to Eddystone, awaited a sale that never came, and was finally trucked downtown to the Franklin Museum in Philadelphia. You can still find her there. She is bereft of her capacity to make steam, but for the benefit of Museum visitors she is occasionally run a few feet by an electric motor.



S. R. Wood collection.

Cole balanced compounds like NYC&HR No. 3000 carried their high-pressure cylinders out on the pilot beam. The Cole system was Schenectady's answer to Baldwin's Vauclain compounds.

It is not fair to say simply that the superheater overtook the compound. Just to say that not only bypasses elementary engineering, it also overlooks what lightweight metals, new devices, and reinforced builder know-how might have accomplished. The old bugaboos of costly maintenance and road failures might have been licked.

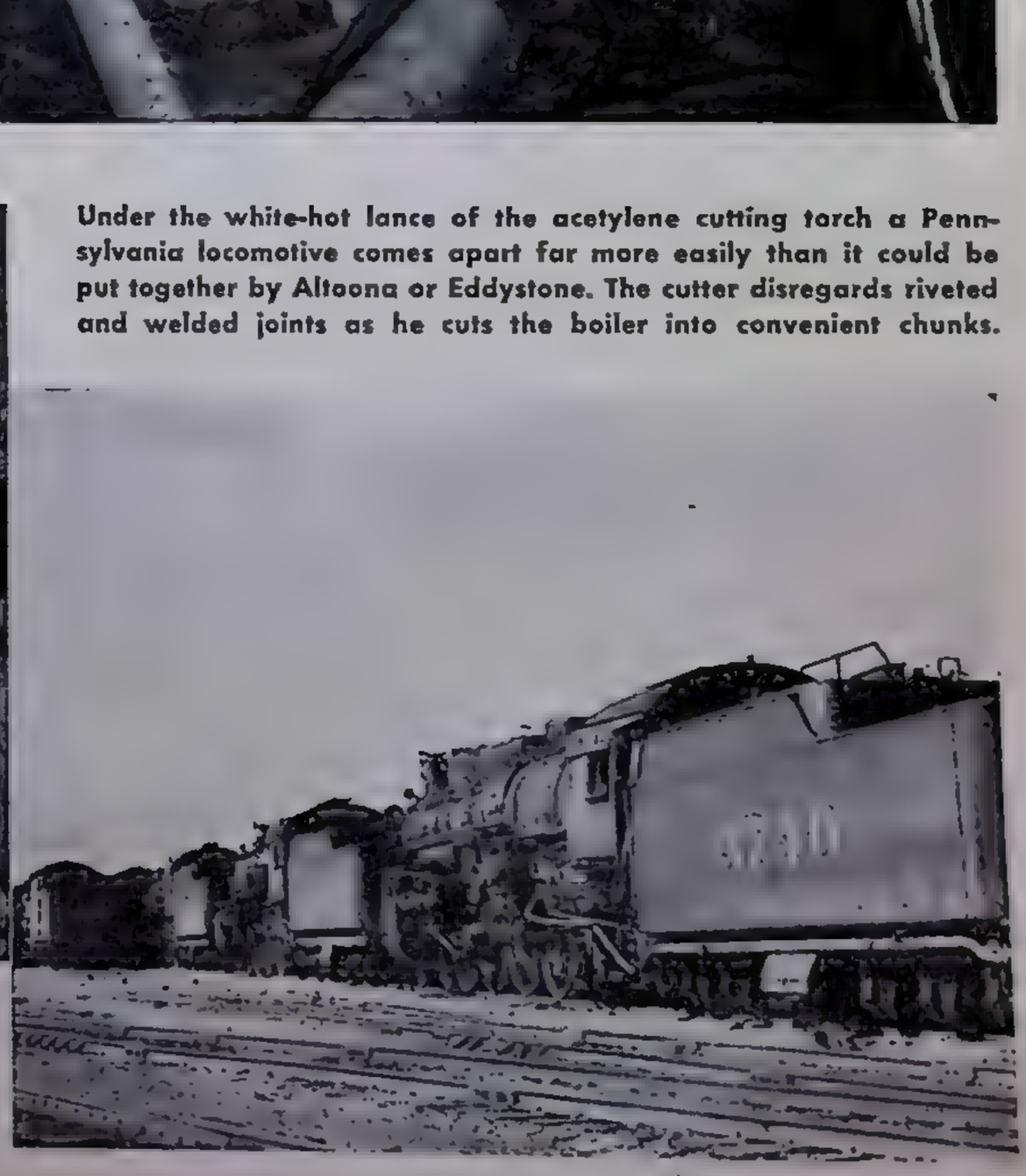
Meantime, it's worth noting that the only steam locomotives placed on order in 1951 are compounds: Norfolk & Western's Y-6b 2-8-8-2 type. The pundits said that compound Mallets were dead, too. But don't tell Roanoke Shops that. Its roller-bearing, syphon and feedwater heater version, with pressure lubrication, is far from dead. Y-6's are out on the road, working up to 24 hours a day, hauling 10,000-ton trains, holding repairs down and monthly mileages up. They are keeping alive a great tradition among steam locomotives.

SCRAPPED

The open hearth furnace is the end of the line for these weary steam locomotives

PHOTOS COURTESY WEIRTON STEEL COMPANY

Under the white-hot lance of the acetylene cutting torch a Pennsylvania locomotive comes apart far more easily than it could be put together by Altoona or Eddystone. The cutter disregards riveted and welded joints as he cuts the boiler into convenient chunks.



↗The weedy tracks of the slag dump yard at the Weirton Steel Company mill at Weirton, W. Va., hold rows of silent New Haven steam locomotives made obsolete by diesels. →The Santa Fe's principal West Coast gathering place for unused engines is San Bernardino (Calif.) yard.

This photo only, Robert Hale.

↘The men with the torches have cut the boiler loose from the running gear, and two overhead cranes are ready to lift it off and set it on the floor so that the cutters can carve it into pieces small enough to fit in open-hearth charging "buggies." This is the steel stock house.

↗A Weirton steelworker attacks the smokebox of a Pennsylvania locomotive. Air reservoir, running boards and backup lights are already gone; the headlight bracket has been burned off. The smokebox front has been sheared off by the flame, can-opener style.

↗An engine's monkey motion sits alone without its boiler. →The floor is white with the boiler lagging of engines which by this time are components of new steel. An oval builder's plate and a Belpaire firebox are the only Pennsy characteristics remaining.

↘After the exterior of a locomotive is cut away, a wealth of scrap metal is inside in the form of boiler and superheater flues and other vital innards. This goggled torchman is standing where the cab used to be. His cut is visible on the firebox side sheet.

↗This engine's cab was stripped of all usable small parts before the scrap company bought it. A cutter sits on the stoker screw and wields his torch under the deck, amputating the firebox grate shaker bars. This step precedes lifting the boiler as a unit off the running gear.

↘Here are two Pennsylvania locomotives which are part-way through the scrapping process. The engine at left has lost the top half of its boiler, exposing the firebox and crown sheet. A longitudinal cut has been made on the boiler of the engine at right, and the top of the boiler will be lifted off like the top of a tin can. Weirton once owned a string of steam locomotives, now uses 10 diesels.

THE admirer of the Pacific type wheel arrangement, as it is exemplified by New York Central's K-11 class, should definitely visit Central's Lake Placid branch. This 16-mile stretch of important feeder trackage deep in the Empire State's Adirondack Mountains offers the searcher a well-rounded program of daily train movements powered exclusively by 4-6-2's in the 4400 and 4500 series. The branch extends from the main line of NYC's Adirondack Division at Lake Clear Junction through a magnificent hill and lake country to the world-famous resort at Lake Placid.

A convenient schedule to the Lake Placid branch from New York City is No. 21, the *North Star*, which leaves Grand Central at 8:15 p.m. with through coaches and Pullmans for Lake Placid. Passengers stir restively in their berths a few minutes past 1 a.m. while these through cars are transferred to Adirondack Division train No. 5 at Utica, bound for the wilds of upper New York State. On through the darkness past Minnehaha, Big Moose and Keepawa jogs No. 5, keeping to a respectable pace of 45 miles an hour out of deference to a track which dodges back and forth between swamps, lakes and mountains. No one is disturbed as No. 5 wends its way toward the Canadian border and Montreal except perhaps the trout, bear and deer (which make this uninhabited terrain a sportsman's paradise) and the spirits of the lumber barons who shaved the land's virgin whiskers. If it were only daylight you might glimpse some remnant of the Fulton Chain Railway or the Raquette Lake Railway, both of which toted fishermen from the main stem to spots of piscatorial pleasure in palmier days. Even in 1950 you may be reasonably certain of seeing an antedated Mogul or the archaic rail bus of the Grasse River Railroad Corporation as No. 5 pauses at Childwold depot to disgorge a couple of sacks of mail in the gray light of dawn.

Daybreak is well in hand as the train stops at Tupper Lake, so it is easy to pick out the old roadbed where the New York & Ottawa branch formerly made its separate way to Canada's capital. As No. 5 picks up speed out of town it bisects a small yard where a K-3 Pacific is raising steam preparatory to an early morning departure on the Lake Placid branch way freight. Another 30 minutes and No. 5's brake shoes bite steel for Lake Clear Junction and the Lake Placid branch turnout.

If you expect to find a busy railroad terminal here you are disappointed, for a search from the train window reveals only a few scattered houses and an unimpressive wooden depot of minimal size. An abbreviated train of two cars and a Pacific is resting opposite the station as No. 5 draws to a halt, and further observation reveals a wye curving off to the east past a large metal water tank. With a 15-minute stop it is safe to unload and watch the switching moves as the Lake Placid cars are switched from mainline No. 5 to branch-line No. 105. A trainman cuts off the two 4500-series 4-6-2's which have

Pacifics to Placid

Oil-burning K-11's wheel tonnage and tourists over an Adirondack Mountain branch which New York Central leases from Delaware & Hudson

TEXT AND PHOTOS BY PHILIP R. HASTINGS

↖Safety valve pops let go on Pacific 4552 after her arrival at Lake Placid with Whiteface Mountain Special. →Sister 4587 shuffles cars from No. 102 over to New York-bound No. 2 at Lake Clear Junction. Placid line leads right.

brought No. 5 up from Utica as, simultaneously, the branch job's locomotive is uncoupled on the adjoining track.

Now the branch engine and the lead Pacific of No. 5's tandem scurry off down paralleling tracks into the clear so that the second engine can place three head-end cars over onto No. 105. Only a single Pacific returns to the mainline consist; when the branch-line engine couples up with the remaining road locomotive it becomes obvious that the doubleheader distinction is being passed to the Lake Placid train. Reason for this change is made plain when No. 5 backs down the main to clear the south wye lead, cuts off its rear five cars, and highballs out of town with a reduced consist. The Placid crew now needs only to back No. 105 off the siding on-

←Vestibule of rear coach on branch-line 105 frames morning arrival of Adirondack Division No. 5 from New York City and Utica; Pacifics 4567 and 4457 lead the train into Lake Clear Junction. At the junction helper 4457 will move over to branch-line No. 105 along with through head-end cars, coaches and Pullmans up from New York and Albany on main line.

↓K-11B No. 4509, an Alco alumnus, stands on siding at Lake Clear Junction with No. 105 for Lake Placid while doubleheading 4-6-2's on No. 5 are uncoupled. Rear helper, Baldwin No. 4457, will perform switching moves, then doublehead with 4509 to Lake Placid. Road Pacific, Alco No. 4567, will wait until switching is over, then go up main line.

to these additional coaches and sleepers, pump up the air, and take off around the wye up the branch.

The first six curving miles of the Lake Placid branch drop 100 feet in elevation to Saranac Lake. No. 105 crosses a series of swamps and intersecting ridges, the low-drivered (69-inch) Pacifics up ahead alternately blasting up short, steep pitches through rock cuttings and forested corridors, then shutting off steam to accelerate rapidly down the other sides of the hog-backs and through lonely marshes. A whistle chime salutes the yard limit board at Saranac Lake and the train slows rapidly as it passes the Saranac wye and locomotive facilities. There is no engine house here; the branch-line passenger engine is serviced and kept here without benefit of protection from weather.

No. 105 decelerates gradually to a complete halt beside a large wooden depot labeled NEW YORK CENTRAL FREIGHT HOUSE. Though this structure was the Central Saranac passenger station a few years ago, it is not the object of today's stop; the town's main drag, Broadway, has a blind crossing with the railroad just ahead and a flagman must be sent up ahead for protection. As the train gets under way again it curves around a knoll and enters a suggestion of a yard which is also fed by a weedy piece of track sloping down between some houses on the left. This unimpressive right of way feature marks a point of great historical interest as regards the Lake Placid branch, for the neglected track is the former Delaware & Hudson line to Plattsburg—

↗No. 101 puffs around the wye at Lake Clear Junction on its way to Saranac Lake after giving most of its cars to New York-bound No. 2. Later in the day this train will return to the Junction as No. 108 to pick up Lake Placid-bound cars from mainline No. 3, up from New York. Through equipment in this seasonal service to Lake Placid is often composed of streamlined room sleepers, indicative of New York Central's interest in keeping this tourist business.

and No. 105 is now entering trackage leased from D&H by Central.

A tidy little city can be seen nestled in the wooded vale which slopes off to the right toward Lake Flower and an Adirondack Mountain backdrop. Saranac Lake is the largest settlement on the branch but its status as a commercial center for the area detracts not a whit from the carefree gaiety of Saranac, the health resort. As many as one fourth of its 7000 residents are folk who have followed the lead of Dr. Edward L. Trudeau and his patient, Robert Louis Stevenson. Both found that resting in this bracing Adirondack climate healed the otherwise fatally progressive lesions of their pulmonary tuberculosis.

As No. 105 pauses to set off an express car in front of the clean-cut graystone Saranac Lake depot you recall the historical vagaries which brought this unmistakably D&H structure under the wing of the New York Central. Half a century ago the traffic monopoly which Central now enjoys into Lake Placid was a shared pleasure with the Delaware & Hudson. In 1903 D&H took over a heterogeneity of narrow-gauge pikes and fashioned itself an 82-mile branch to Lake Placid via Saranac from its main line at Plattsburg. The trackage between Saranac Lake and Lake Placid (known as the Saranac & Lake Placid) had previously been set up as a double-gauge line to accommodate the trains of the three-footer from the east as well as the standard equipment of the Adirondack & Lake Lawrence (now NYC's Adirondack Division) from the west. D&H immediately standard-gauged its new branch but Central managed to reap the lion's share of the tourist harvest because it controlled the major metropolitan routes and had a shorter way to go. In 1947 D&H finally bowed out of the Lake Placid scene altogether, leasing its Saranac-Lake Placid trackage to Central and retrenching its rails to the iron diggings at Lyon Mountain, 37 miles out of Plattsburg.

Thus it is that when No. 105 finishes its station business at Saranac and whistles off across the Plattsburg highway, its remaining 10 miles of run up the branch are marked off by D&H-placed mileposts. As the train's paired Pacifics charge across the Saranac River bridge to hit the grade out of town, you may glance back to the left from the car window and catch some of the homey cottages of the Trudeau Sanatorium clustered about a pretty hillside. A few winding train lengths more open up a last brief look at Lake Flower before No. 105 ducks under the Variety Club's Will

↗A single merchandise car is the consist on the Lake Placid way freight as Pacific 4587 wheels it over the Saranac River girder span. Saranac Lake originates most branch tonnage.

Pacific No. 4598 (top) has a midnight draught of fuel oil at Saranac Lake, where she boards between trips on Lake Placid branch passenger trains. K-11's 4552 and 4549 (bottom) gather speed toward the mile of 2 per cent grade ahead as they curve the Whiteface Mountain Special uphill past the Saranac Lake Country Club. At the end of the tangent climb lies the 2500-foot elevation of Seymour Mountain. Lake Placid is only a few minutes' ride away for the Special.

↗Lake Placid-bound No. 105, accelerating away from a state tuberculosis sanatorium stop at Raybrook, ripples its reflection across the waters of an artificial mill pond. Up ahead No. 4509 handles the head-end honors. All NYC engines on the Lake Placid branch burn oil to curb forest fire danger. Delaware & Hudson locomotives once also burned oil along this railroad.

↗The Whiteface Mountain Special is into the stub-end NYC yard at Lake Placid. Road engine beyond station is identified by steam plume. Meantime helper Pacific No. 4552 has been turned on table and is coupled on rear of train, ready to switch the coaches and sleepers once all the passengers have disembarked. Hazy mountain outline is the Sentinel Range of the Adirondacks.

Rogers Sanatorium, haven for tubercular show people. Four miles farther upgrade the train stops again, this time beside a beautifully placid pool, while passengers climb off at the state TB sanatorium, Raybrook.

The scenery shifts now from the park-like grounds of Raybrook to the undulating terraces of the Saranac Lake Country Club — and then 105's engines really dig in for the last and steepest grade up toward Lake Placid. Whiteface Mountain and its ramparts raise their great bulks nearly 5000 feet skyward only a few miles distant, but their peaks are hidden from the train windows by the forested slopes which hem in the railway. No. 105 has consumed most of the 26 minutes allotted for the six-mile climb from Raybrook to Placid when it finally tips over the peak of the watershed and eases off down the eastward AuSable flow, an emission originating in the body of water for which Lake Placid village is named. A 20-mile-an-hour speed limit for a series of tortuous curves keeps the train at a sedate pace until, rounding one last bend of the AuSable River, it comes abruptly upon a neatly arranged little railroad yard. Its Pacifics ease to a halt beside another D&H-styled stone depot.

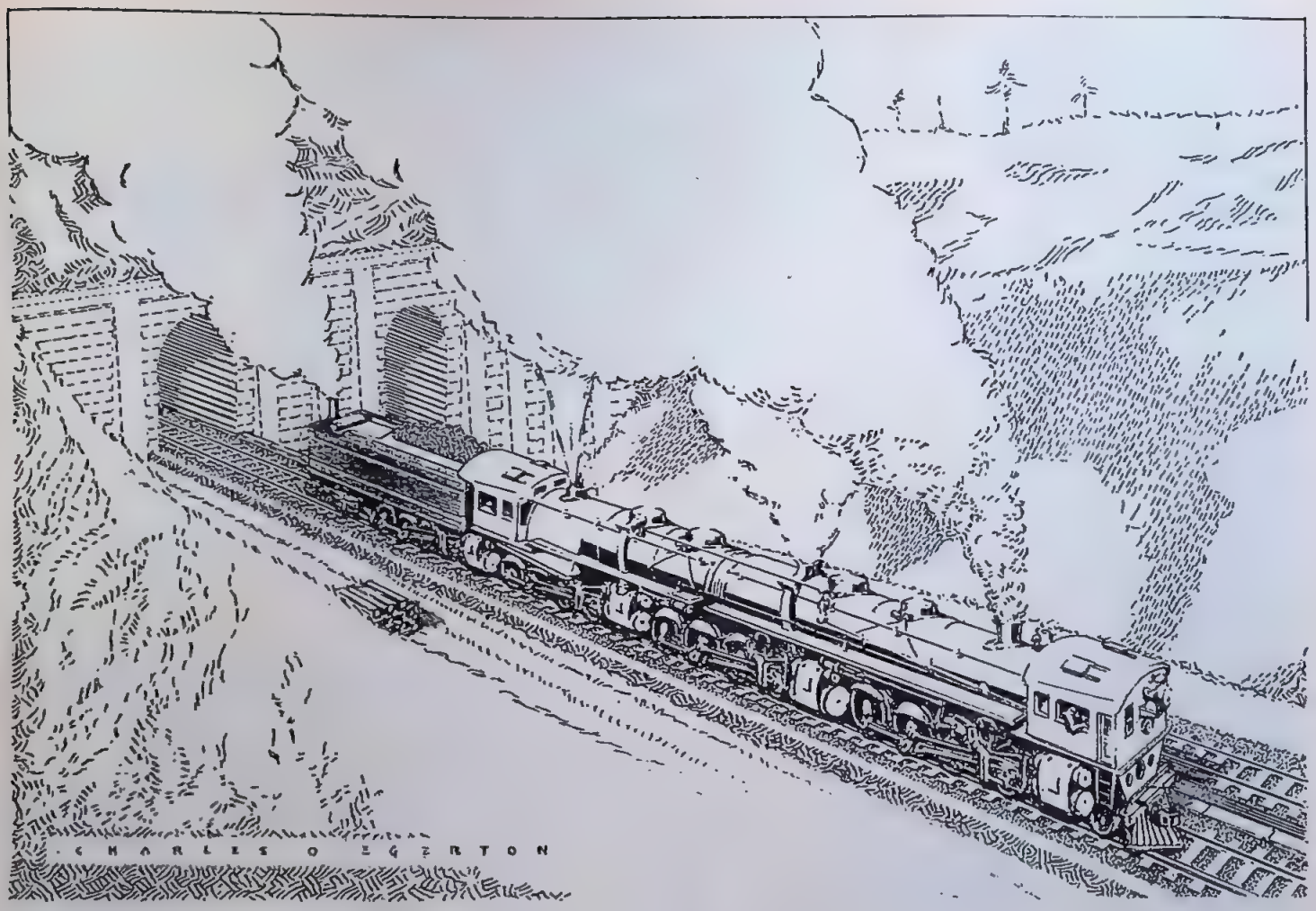
Not much of the village is seen, for most of its buildings lie up over a hill and slope down toward Mirror Lake on the other side — but the silvered image of nearby peaks in the AuSable and the proximity of lofty fir trees is proof enough that this is indeed Placid, Gateway to the Adirondacks.

Later in the morning, after the road engines have completed necessary switching, one of them takes No. 102 to the main line. Midday on the branch belongs primarily to the Pacific-powered way freight, which works up the hill and back from Tupper Lake. Toward suppertime the branch-line passenger Pacific quits its Saranac Lake layover and returns to Lake Clear Junction, once again to pick up cars from mainline No. 3.

Finally, the coolness which comes with mountain nights creeps down the valley of Ray Brook toward Saranac's screened porches. With it goes the rumble of steel NYC wheels on D&H rails as Pacifics cant to the curves of the Lake Placid branch with the "midnight" for New York.

Philip R. Hastings.

Even when it is dormant, a steam engine is an active thing — glowing warmly in the evening chill, winking through many eyes, and softly sputtering a steamy melody. Resting thus is a Boston & Maine Mogul in the roundhouse at Woodsville, N. H.



This sketch is of a compound articulated locomotive that was never built for the Santa Fe, on whose line it is shown in Raton Pass, or for any other road. It is Artist Egerton's conception of what George Henderson's 2-8-8-8-8-2 would have looked like had Baldwin built it.

What might have been

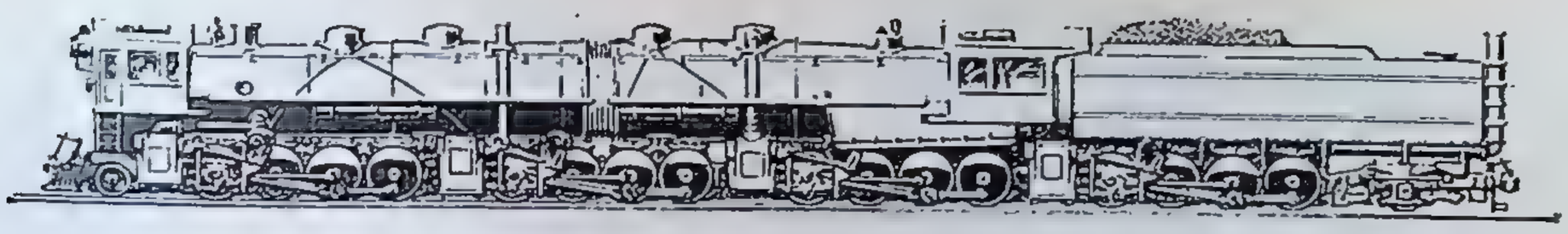
An artist, borrowing the thoughts of a noted designer of steam power, elaborates on a proven principle

GEORGE R. HENDERSON believed in the idea of the compound articulated locomotive. The principle of using steam first in a pair of high-pressure cylinders and then again in a pair of low-pressure cylinders seemed to him to be logical, economical, and entirely suited to the task of moving the heavy freight trains of the first few years of the 20th century.

In those years Henderson was an engineer for the Baldwin Locomotive Works. It was from his drafting pen that came the designs for the *Matt H. Shay,* a compound triplex 2-8-8-8-2 that the Erie put to work in 1914 shoving trains out of Susquehanna, Pa.

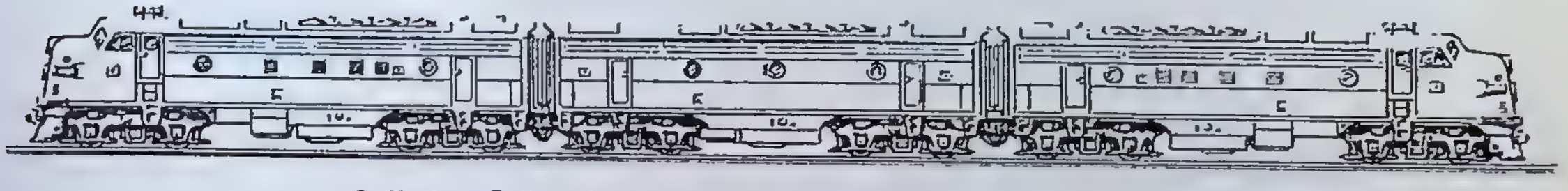
In the *Matt Shay* the motive-power world saw the first triplex locomotive to be born unto an American railroad — an engine which had three sets of drive wheels, each powered by a pair of cylinders. One "engine" (the technical term for a set of cylinders and drivers) supported the tender. In the *Matt Shay,* too, the motive-power world saw an attempt by Henderson to elaborate on the principle of the articulated locomotive. The *Matt Shay* was successful enough to warrant the building of two similar locomotives in 1916. None of the Erie's triplexes, however, lived to see the ripe old age of some of the less spectacular power of the same era.

But Henderson saw no reason for stopping with the triplex. In 1913 he filed drawings and an application for a patent on a quadruplex, a 2-8-8-8-8-2, a design that the Santa Fe was interested in. It was to be quite a locomotive! Henderson's drawings and specifications showed a cab on the front end (astride the smokebox) for the engineer, and a cab in the usual place for the fireman. They were to be connected by signal appliances and a speaking tube. Three



QUADRUPLEX STEAM LOCOMOTIVE OF 1915

HORSEPOWER	8000
TRACTIVE EFFORT	200000 LBS.
OVERALL LENGTH	129 FT 10½ IN.



E.M.D. F-7 DIESEL ELECTRIC OF 1949

HORSEPOWER	6219
TRACTIVE EFFORT	157200 LBS.
OVERALL LENGTH	159 FT 4 IN

Henderson's multi-legged, accordion-pleated quadruplex would have been, according to design, shorter and more powerful than a modern EMD diesel. The jointed boiler was a Santa Fe innovation; the cab-forward idea was used later on oil-burning Southern Pacific Articulated Consolidations.

The Santa Fe had some 2-10-10-2's (the 10 members of its 3000 class). Henderson's patent covered a quintuplex wheel arrangement. Combine the two designs and carry them to what some might, some might not, call an extreme, and you have a new theoretical behemoth, a 2-10-10-10-10-10-2.

of the four driving frames were to be under the boiler; the fourth was to be under the tender.

The boiler itself was a monument to untried ideas of the time. Actually, it was designed as *two* steam-generating units complete with tube sheets, flues and combustion chambers, but with one firebox. Henderson had good reasons for dividing the steam-making unit of his quadruplex: the boiler was to have an accordion-pleated joint in the middle so that the entire locomotive would bend when going around a curve; the locomotive would in effect be two complete locomotives, with a separate boiler supplying steam for each set of high-pressure cylinders; and there would be less fluctuation in the height of the water in the boiler, and therefore less danger of exposing the firebox crown sheet.

Jointed boilers were tried out on a few Santa Fe compound 2-6-6-2's built by Baldwin a few years earlier. The joint took two forms: a metal accordion or a ball-and-socket connection. All Santa Fe articulateds were either rebuilt into conventional two-cylinder locomotives or scrapped. [See "The Jointed-Boiler Locomotives," February 1945 TRAINS.]

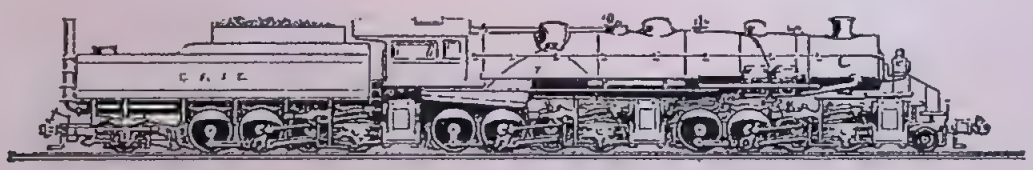
To create enough draft in the boiler to build up steam, Henderson included in his patent application the idea of a steam-turbine-type fan in the smokebox which would create a suction in the firetubes.

Henderson's quadruplex was to have 60-inch drivers, 27 x 32-inch high-pressure cylinders, 41 x 32-inch low-pressure cylinders, a total weight of about 885,000 pounds, and the enormous tractive effort for the day of 200,000 pounds.

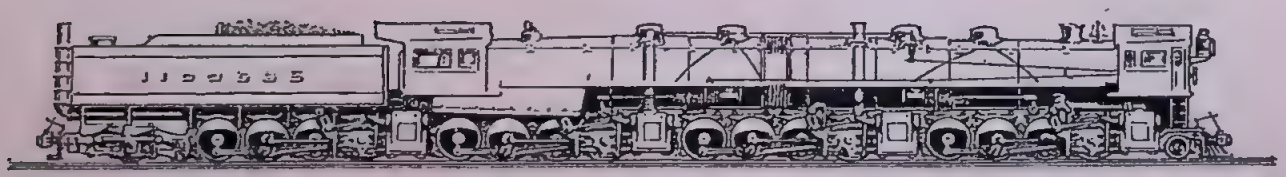
But both the idea of articulated steam locomotives and the idea of using steam twice began to wane until today only two roads (Norfolk & Western, Chesapeake & Ohio) hold faith in them as a combination. George Henderson's quadruplex never followed its little brother, *Matt Shay,* out through the Baldwin gate.

But Henderson didn't stop even when he had (in theory) four sets of drivers under a locomotive and its tender. In the same patent application he mentioned the possibility of coupling on behind his quadruplex a second tender which also would have four driving axles and a set of cylinders! He figured that the steam from the rear high-pressure cylinders could be divided, half going to the low-pressure cylinders on the first tender and half going to the cylinders on the second tender. So, in effect, he had protected himself on the designing of a quintuplex — a 2-8-8-8-8-8-2! But this behemoth to end all behemoths in the railroad motive power field suffered the same fate as Henderson's other elaboration on the *Matt Shay*: It never saw the interior of the Baldwin erecting shop.

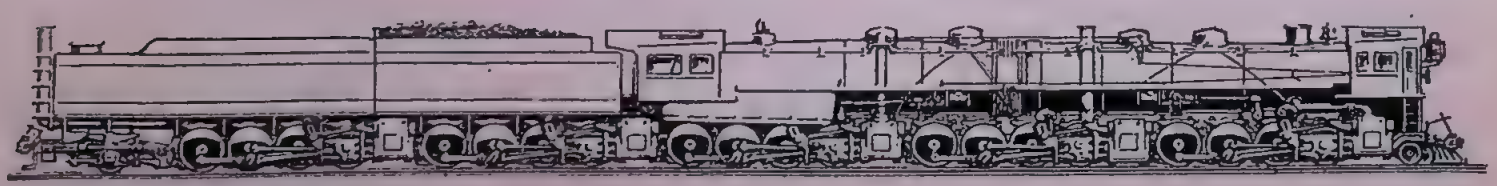
Apparently Henderson's ideas for super-articulated locomotives never were transferred to any great number of drawings that became widely circulated. It has been left for Artist Charles O. Egerton, in these three pages, to transfer complicated plans, brief outline drawings, and printed specifications into illustrations that show how the quadruplex and quintuplex might have looked.



TRIPLEX

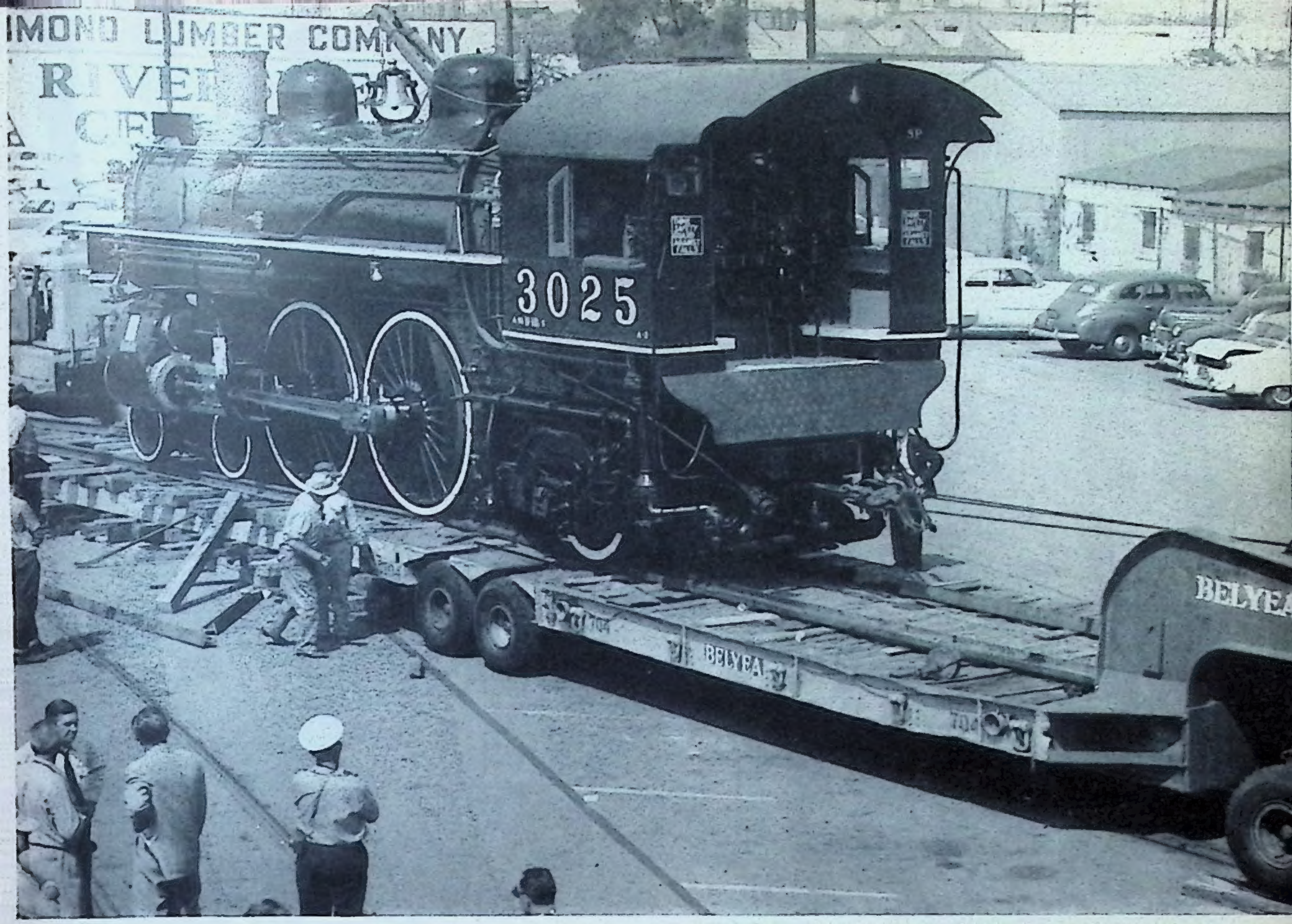


QUADRUPLEX



QUINTUPLEX

If the Baldwin Locomotive Works had built George Henderson's eight-coupled quadruplex and quintuplex locomotives, and if you were to stand back from the track and look at them, this is how they would compare to the Erie's Matt H. Shay, the one Henderson elaboration on the compound articulated principle that felt the pull of a heavy freight drag. The "quint" (bottom) would have had joints in both boiler and tender.



Belyea Truckers put a 104-ton load on rubber tires.

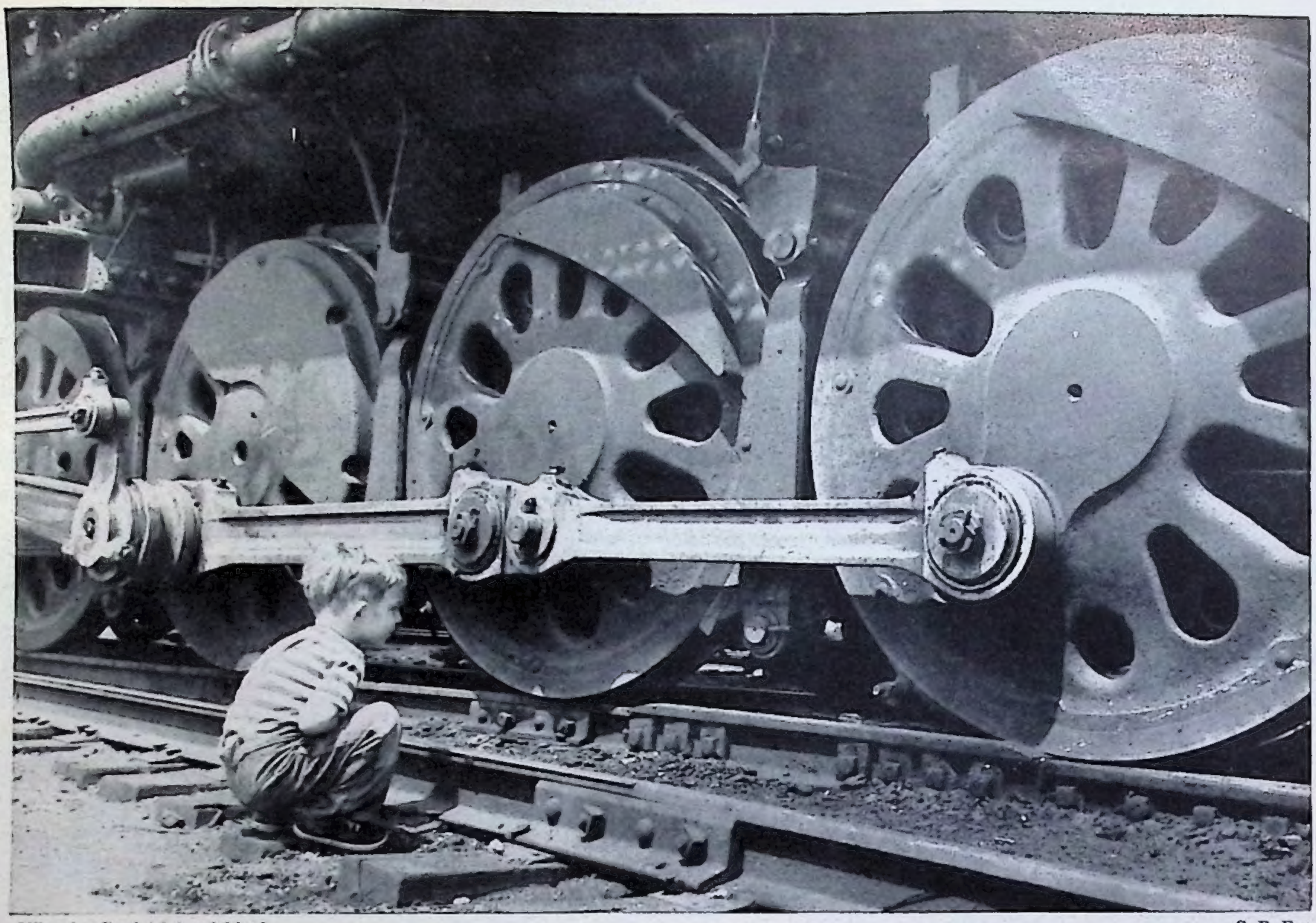
How to retire a locomotive

WHEN the Southern Pacific presented an honest-to-gosh steam locomotive and tender to the children of Los Angeles, the city where the stupendous is so-so accepted the 129½-ton gift without elevating an eyebrow — notwithstanding the circumstance that Atlantic No. 3025 was delivered f.o.b. the Glendale passenger station, 4¼ miles of boulevards from her intended site in Griffith Park.

The Belyea Truck Company, a specialty mover, offered to handle the job free as a public service. In the past Belyea's boys had moved everything from boats to planes, including a 200-inch telescope mirror up to Mount Palomar Observatory and a 170-ton press out to Lockheed Aircraft. For them a locomotive was all in the day's work.

Espee parked the freshly painted and polished 4-4-2 on a spur near its Glendale depot and at 7 a.m. on Friday, October 3, Belyea showed up with two 16-wheel low-bed trailers, two 10-wheel tractors and a jeep. A trestle was erected to roll the 3025 up the 3½-foot rise from the siding to the trailers and by 10:30 the crews were ready to load. The Vanderbilt tank was a cinch but the 3025 herself took a little longer; a sand pipe and the pilot finally had to be knocked off to roll her aboard. At 1:30 p.m. the cavalcade took off, with alternate motorcycle squads of Glendale and Los Angeles police preceding the 129½ tons of motive power riding along on 90 feet of trailer and 42 tires. With motorist's luck the Belyea crew suffered a blowout en route; an 18-ply tire let go on Riverside Drive. The flat was fixed and by 6:30 engine and tender stood safely on the exhibit track constructed by the Espee for Griffith Park's new "Travel Town." That weekend over 7000 people crowded into the park to see the Atlantic.

What they found was a famous locomotive. Constructed by Schenectady in 1904, the 3025 had regularly worked the *Lark* on the Espee's Coast Division from San Francisco down to San Luis Obispo. She also pulled the presidential specials of Theodore Roosevelt, William Howard Taft and Woodrow Wilson as well as the train which carried Queen Marie of Rumania. Larger power bumped the 81½-inch-drivered engine down through the ranks until, at the time of her rescue from sure scrap, she was serving as a stationary boiler for the roundhouse at Indio, Calif. — D. P. M.



Milwaukee Road 4-8-4 and friend. O. P. Fox.

Gee whiz

HE places his little hand in yours and holds on tight as you walk about the engine terminal, which is just as well for he's so engrossed in the power on the ready track that you must guide him over the rails and around the standing pools of muddy oil. He waves to the hostler filling the slope-back tank of an ancient 0-6-0 and asks you which way a four-unit freight diesel with a cab on each end is headed. He is intrigued by a pair of men cleaning the firebox of a Mike on the ash pit.

For seconds he is awed and standing very close to you as a passenger engine backs past with its cylinder cocks open. He studies the white clouds of steam shooting forth from the Pacific and curling about his feet, then he glances up at you with a small uncertain grin.

Beyond the coal tower he releases your hand and runs to where a black, dirty 4-8-4 is standing alone. He scurries alongside the bulk of its boiler, then squats down to make his own examination of its four-coupled disc drivers.

"Gee whiz."

Then, "How fast will she go, Dad?"

"About seventy-five or eighty."

He asks about sand pipes and domes and air pumps and power reverse, and your answers recall the spring when the S-2's were new and you pedaled out past Highway 100 to watch them come fighting up the grade through Elm Grove to Brookfield. The Baldwins came in 1938—before the university and the Army and Margaret. And before the diesels. The sight of Rod getting his hands all black and grimy on the main rod of an S-2 makes 1938 seem far away and not quite real.

"Dad, is this better than a diesel?"

"No."

"Why not?"

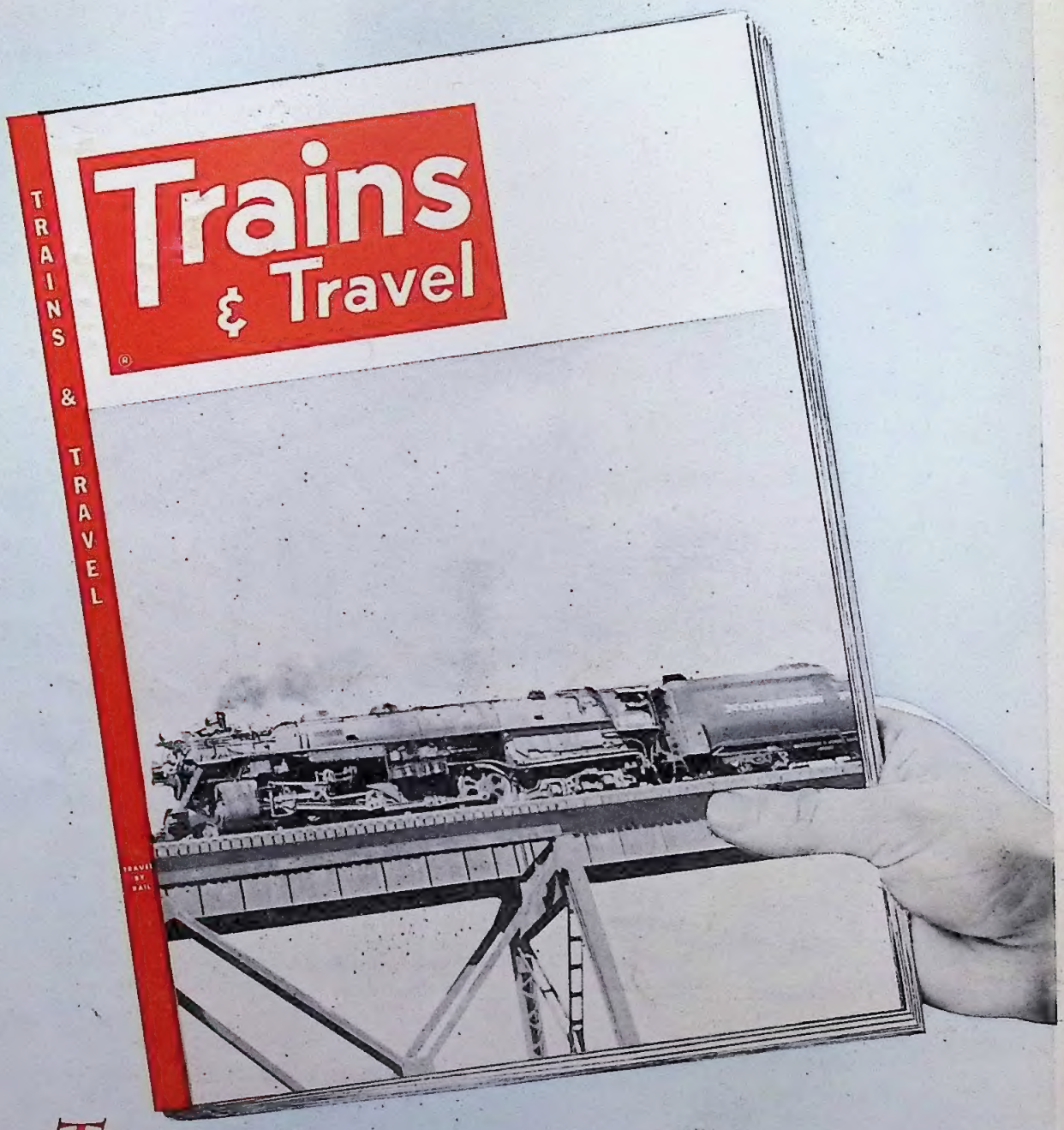
"A diesel pulls more cars," you hear yourself saying, "and it doesn't go to the shops so often. Nobody builds steam engines anymore."

"I like steam best," he says flatly. "Don't you, Dad?"

He searches your face intently for a moment, then grins because he knows that you know that nothing on wheels is better than an S-2.

1938? Not so long ago. — D.P.M.

The conductor passes up train orders to the engineer of a Texas & Pacific 2-10-4 waiting to leave.



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